

# Journal of Applied Microscopy

and

## Laboratory Methods

Vol. IV

January, 1901

No. 1

## LEADING SUBJECTS

Moses C. White.	
S. H. GAGE, Cornell University,	1109
Fire in the Veterinary College at Cornell.	
S. H. GAGE,	1111
Laboratory Photography.	
Stereo Photo-Micrography,	1113
The New York Botanical Garden.	
D. T. MAC DOUGAL,	1115
Preliminary Study of Mycetozoa.	
CLARA LANGENBECK, Wells College,	1119
Micro-Chemical Analysis, X. Potassium.	
E. M. CHAMOT, Cornell University,	1121
Easy Method of Mounting and Preserving Mosquitos.	
V. A. LATHAM, M. D.,	1129
Current Botanical Literature.	
CHAS. J. CHAMBERLAIN, University of Chicago,	1131
Cytology, Embryology and Microscopical Methods.	
AGNES M. CLAYPOLE, Cornell University,	1133
Normal and Pathological Histology.	
RICHARD M. PEARCE, M. D., Harvard College,	1136
General Physiology.	
RAYMOND PEARL, University of Michigan,	1138
Current Bacteriological Literature.	
H. W. CONN, Wesleyan University,	1141
Notes on Recent Mineralogical Literature.	
ALFRED J. MOSES, LEA McL. LUQUER,	1144
Medical Notes,	1145
News and Notes,	1147

Publication Department BAUSCH &amp; LOMB OPTICAL CO., Rochester, N. Y.

Entered at the Post Office at Rochester, N. Y., as Second Class Matter.

# JUST ISSUED



## BACTERIOLOGICAL CATALOG

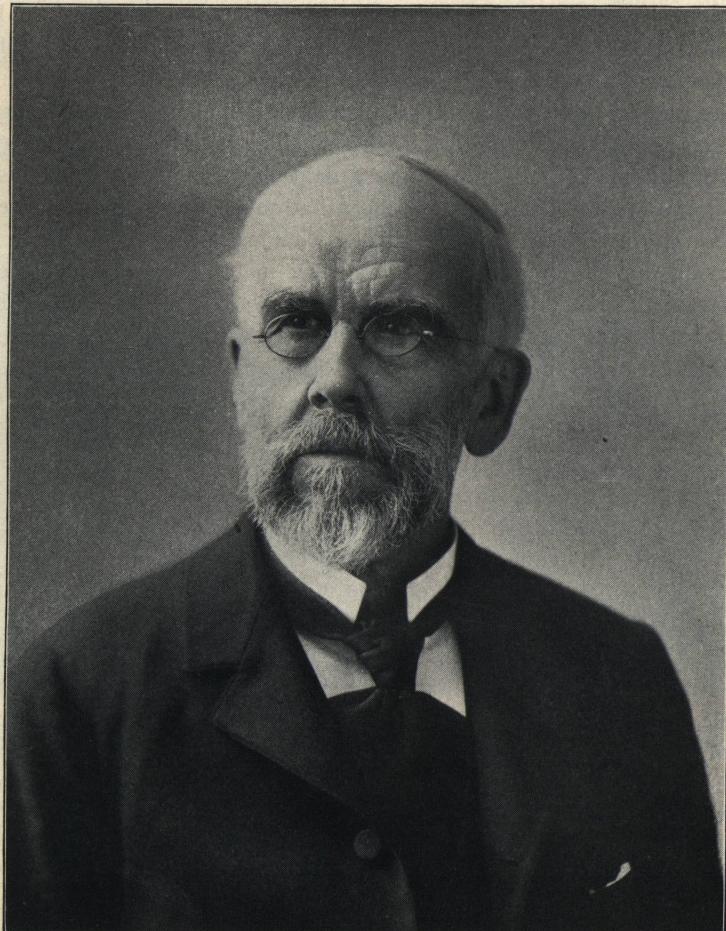
Send for one to  
BAUSCH & LOMB OPT. CO.  
Rochester, N. Y.

# Journal of Applied Microscopy and Laboratory Methods.

VOLUME IV.

JANUARY, 1901.

NUMBER 1



MOSES C. WHITE.

### Moses C. White.

Moses Clark White, born in Paris, Oneida county, N. Y., July 24, 1819, died in New Haven, October 24, 1900. It will be seen from this brief summary that Dr. White was in his eighty-second year. His life is one pleasant to reflect upon. Like the career of so many Americans, it was full, and showed the vitality of this new world. In 1840 he went to the Cazenovia Seminary—the seminary which has given a start to so many noble men and women in the central part of New York State. Here he prepared for college and entered Wesleyan, graduating with the class of 1845. For the next two years he studied medicine and theology at Yale, and in 1847 went as a medical missionary to Foo Chow, China. Here he took charge of a public dispensary, and gained the confidence of all classes of the people. Owing to illness in his family he was compelled to return to America in 1853. He settled as a physician in New Haven, Ct., and in 1857 became a teacher in the Yale Medical School, and at the time of his death still held an honored place in the faculty. His work in this school, dealing with the microscopic structure and pathology of the body, naturally made him one of the ardent advocates of the microscope in medicine, and his work outside the college had much dependence on the microscope as the instrument of research or demonstration. Thus from 1869 to 1875 we find him giving lectures in his alma mater, Wesleyan, on the microscopic structure of animals and plants. He was naturally led to consider various medico-legal questions in which the microscope played a principal role. When the great Reference Hand-Book of the Medical Sciences appeared some ten years ago, one of its most accomplished articles was the one on "Blood-Stains," by Dr. White. Since that time he has written one or more monographs on blood and the determination of the corpuscles of different animals. He has also presented papers before the American Microscopical Society on various topics, in which especially difficult phases of the subject were handled with rare skill and success. Even at the last meeting of the society in New York he presented a paper which gave in the clearest manner the difficulties of photographing absorption bands in certain parts of the spectrum. His exposition was an inspiration to the younger members, for it showed how the human mind could triumph over difficulties by intelligent persistence. Not only has he presented admirable papers before the Microscopical Society, but his discussion of the papers of his fellow members was always full of interest and sympathy, and it was rare that he did not add some exceedingly good suggestion which helped the writer of the paper and impressed all with the fertility of his mind and its thorough grounding in experience as well as in fundamental principles.

The men who built the foundations of American science are fast passing away. Dr. White has an honorable share in that relating to microscopy. "He assisted largely in the preparation and publication of Silliman's Physics, and wrote the chapter on optics." His efforts to make clear to classes the microscopic structure of organisms led him naturally to try to so improve the projection microscope that all could see at once, and the teacher be able to point out

exactly what feature he wished to be observed. For this he conceived of special projection lenses, as one can see by consulting p. 194 of the first volume of this JOURNAL. The projection microscope will ultimately be a perfect instrument by the loyal and intelligent investigation of the problem, such as he gave.

It would be cruel to begrudge the repose which a full and noble life has earned; but we can rightfully hold fast to the inspiration which his earnest, helpful life gives, and like him strive to advance knowledge, and "lend a hand."

Cornell University.

S. H. GAGE.

### Fire in the Veterinary College at Cornell.

November 13th, in the early morning, the New York State Veterinary College took fire and the Bacteriological and Histological laboratories situated on the third floor were completely destroyed. Pictures of these laboratories were published in the JOURNAL OF APPLIED MICROSCOPY, Vol. 1, p. 23.



The origin of the fire is supposed to have been the extinguishment of the gas owing to low gas pressure in some of the incubators. Upon an increased pressure the room was filled with gas and ignited by the flame of the incubator, which did not go out. This is simply hypothesis, however.

The two pictures show very well the conditions existing Tuesday forenoon. In the laboratory, the twisted girders which supported the roof, and numerous people engaged in clearing the wreck or students trying to discover some of their lost property. The other picture shows the east side of the building before the fire was extinguished.

The slow burning construction enabled the fire company to hold the flames

to the middle part of the third floor, the two ends of this floor being injured only by smoke and water, and the lower floors only by water. Only the building was insured. The material, microscopes and movable furniture were not insured. Over forty microscopes, each completely equipped with two-thirds, one-eighth dry and one-twelfth oil immersion objectives, triple nose-piece, Abbe condenser, and two oculars, were completely destroyed. The material for the courses in Pathology, Bacteriology, Histology and Embryology were all burned, besides much valuable material for research which had been collected with much care and no little expense during the last ten years.



While much was lost, much more was saved. Fortunately the most valuable microscopes and apparatus were stored in the wings or ends of the main building, and these escaped except some blackening by the dense smoke.

By Friday evening a temporary roof had been put over the burned part, and by utilizing the museum space on the first floor for a laboratory, the work was in full progress the next Monday morning. The professors in charge wish to express their grateful appreciation to their colleagues all over the country for their generous offers of assistance; they are also grateful to the manufacturers and optical companies which supplied them immediately with needed apparatus, or repaired damaged instruments.

S. H. GAGE.

Cornell University.

---

A recent writer on Fat-necrosis finds alcohol with celloidin imbedding preferable to formaldehyde (4 per cent. solution), Müller's fluid, Flemming's solution or osmic acid as a fixative for necrotic adipose tissue and specimens of pancreas. Hæmatoxylin and eosin were found the most satisfactory for staining.

## LABORATORY PHOTOGRAPHY.

### STEREO PHOTO-MICROGRAPHY.

Mr. John G. Baker has sent us a number of very interesting micro-stereographs of insects and the following description of the apparatus and methods employed in making them. The work was first publicly exhibited and described June 6th, 1899, before the Photographic and Microscopical Branch, Chemical Section, of the Franklin Institute.

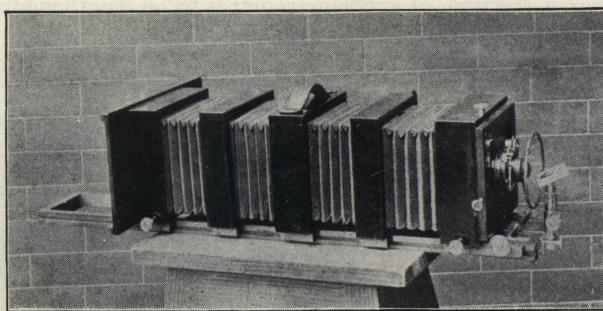


Figure 1.

This camera was constructed for the purpose of making stereoscopic pictures of small objects.

My first attempt was in fitting up a stereoscopic camera for the purpose, but the result was not at all satisfactory, although it made some very fair negatives. The camera proved to be very much too short, and the lens and object had to be changed from one side to the other, all of which made it very inconvenient.

The next attempt is embodied in the instrument shown in the illustration. It was originally a lantern slide camera, which was altered to what you now see. The shutter used is a 4 x 5 "Victor." To the front of this was fitted an attachment to carry the lens and also to hold a reflector for properly illuminating the object. In the rear of the shutter, instead of a lens, a ring was placed to cut off any reflected light. The rear end of the camera has been fitted up to receive a 5 x 7 plate-holder, but in such a way that it may be used in two positions, so that each end of the plate may be exposed independently of the other. The plate-holder rests against a partition with an opening in it of a size just sufficient to cover one-half of the plate.

The lenses for very small objects are achromatic objectives that are used in the microscope, but for this work are changed somewhat, to better answer the requirements.

The trouble found with them for the work was their narrow angle of view and extremely small depth of focus, and each of these faults had to be remedied before it was possible to make a satisfactory negative. It was also found that the rays of light, in passing through the lens, had a tendency to fog the plate by coming in contact with flat surfaces, even when these were blackened with the

greatest care. This trouble was overcome satisfactorily by dispensing with the flat surfaces; i. e., by making them on a bevel, with only the sharp edge to reflect the light.

To do away with the difficulty arising from the small depth of focus, the only way found was to stop down the lens.

As the depth of some objects is very great in proportion to the focal length of the lens, it necessitates the use of a very small stop. The smallest stop used by me for this work has a diameter of  $\frac{1}{1000}$  of an inch, and the edges of the opening are made nearly sharp and carefully blackened. The rear of the lens has also to be guarded to prevent reflections which in this work would be very serious. Of course, the time of exposure requires to be lengthened in proportion to the size of stop; many times the exposure has taken over thirty minutes, and as each exposure must be made separately on the plate, the time will be doubled.

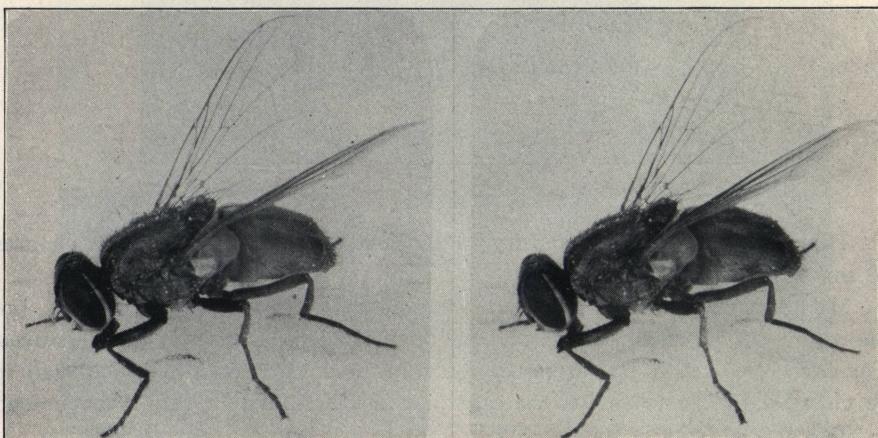


Figure 2.

Suppose the object to be photographed is a small living insect. It is placed under a tumbler which has a small hole drilled through the bottom. Through this opening is injected a small quantity of ether. This soon places the insect in a condition to be handled. We then set it up on its feet in a position as nearly life-like as possible on a small piece of opalin glass, and, to hold it in position, each of its feet is fastened down by means of wax. This is done by using a very small tool, heated in the flame of a spirit lamp. After the feet are fastened properly, the insect is placed in strong fumes of cyanide of potassium to end its life. The surplus wax is now carefully removed by scraping it away with a fine pointed knife.

The object is now ready for the camera, and upon the pedestal in front of the lens the mounted object is made fast. The pedestal, upon which the mounted object is fastened, has a rack and pinion movement, so as to elevate the object to the required height, and has also a ball-and-socket joint on the top, so that the object can be placed in any desired position. The image on the focusing

screen is brought in position horizontally by sliding the lens and board, which can be done by turning the milled head on the top of the camera.

To make the exposure, place the object in its best position and focus as sharply as possible. With the image in the proper place on the screen, fasten front and rear of camera by means of the clamp screws at the side, run in the plate-holder until it drops into the *first* groove. Set the camera in position, with the reflector facing a northern sky, and make the first exposure.

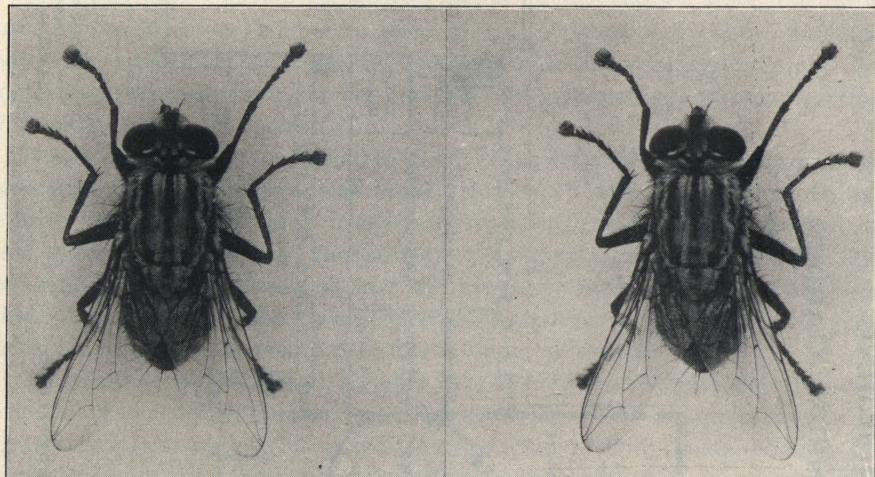


Figure 3.

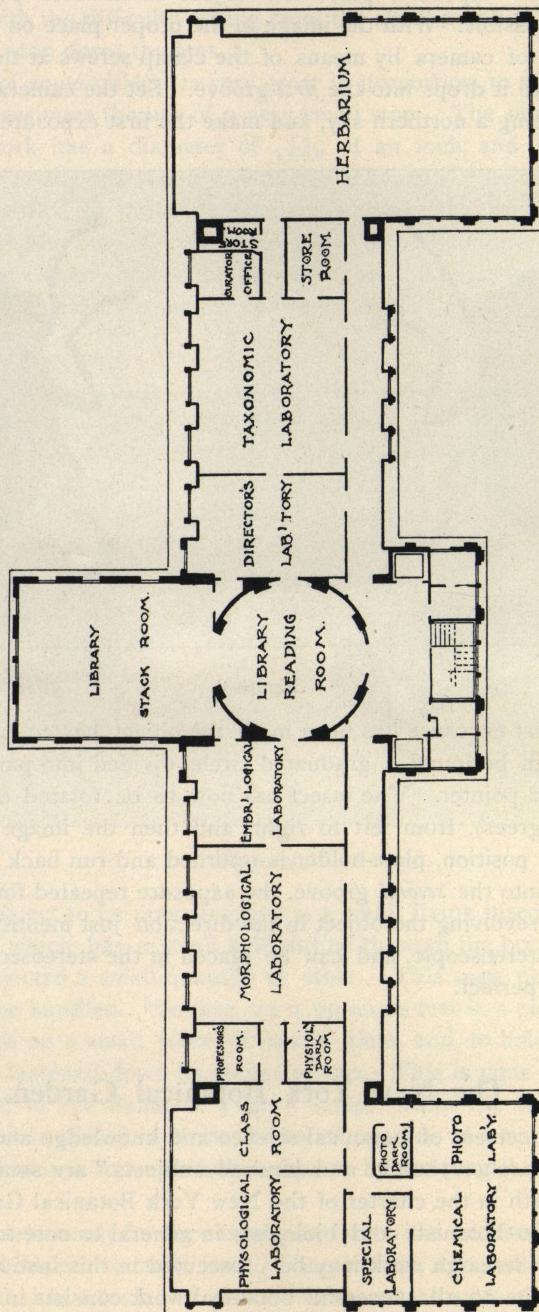
After the first exposure has been made the object has to be rotated. Upon the pedestal will be found a graduated circle, divided into parts of five degrees each, and also a pointer. The insect has now to be rotated one of the graduations (five degrees), from left to right, and then the image on the screen is again placed in position, plate-holder is returned and run back as far as possible until it drops into the *second* groove, the exposure repeated for the other end of the plate. By revolving the object in the direction just mentioned, the negative itself is made stereoscopic, and can be placed in the stereoscope and examined to see if it is perfect.

### The New York Botanical Garden.

"The advancement of botanical science and knowledge and the prosecution of original researches therein and kindred subjects" are some of the primary purposes set forth in the charter of the New York Botanical Garden, and it may be of interest to botanists and biologists in general to note to what extent and in what manner research work may be prosecuted in this institution.

A prerequisite to all successful botanical work consists in the possession of typical specimens, and in experimental work it is important that normal conditions of growth should be available, as well as facilities for producing and controlling experimental factors.

MUSEUM BUILDING  
NEW YORK BOTANICAL GARDEN



PLAN OF THIRD FLOOR

SCALE OF FEET  
0 10 20 30 40 50 60 70 80 90 100

ROBERT W. GIBSON  
ARCHITECT,  
54 BROAD STREET, NEW YORK.

The herbarium contains nearly a million specimens, and is composed largely of plants which have been subjected to critical study, and are consequently well identified. Some very notable collections are embraced, and it is especially rich in American forms, and in ferns, fungi, and mosses. In addition to being the primary means of research bearing upon the natural affinities of plants, it is invaluable as a reference collection in morphological studies. The herbarium is increasing at the rate of fifty to a hundred thousand specimens annually.

The living plants include the species native to the Garden tract, the introduced forms from the temperate zone in the herbaceous grounds, pinetum, fruticetum, arboretum, viticetum, nurseries and boundary plantations, and the tropical and desert forms in the horticultural and propagating houses, amounting to about six thousand species.

Before beginning an investigation of any botanical subject it is of the greatest importance that the worker should familiarize himself with its botanical history to learn what other botanists may have written concerning it. To this end he must search the volumes in the library. Periodicals, books, pamphlets, and manuscripts must be examined, and the extent of known facts gotten well in mind. The library of the Garden now contains nearly nine thousand volumes, and is increasing at the rate of over fifteen hundred volumes annually.

The facilities of the Garden are open only to students who have demonstrated their ability to carry on independent research work, and no attention is given to elementary instruction. The intending investigator, having complied with the regulations of the institution and secured a table, is placed in consultation with the member of the staff, or other attending botanists most familiar with the subdivision of the subject in which his problem lies, from whom he receives only so much help and advice as may be necessary to enable him to carry his work to a successful end. The student is free to offer the results of his work in the form of a thesis to any university at which he might become a candidate for a degree.

The actual arrangement and extent of laboratory space and organization of the equipment of the laboratories have been carefully worked out. The upper floor of the museum building, with an area of nineteen thousand square feet, and some special rooms in the basement, are devoted to research work. The library is housed under the dome and in a stack room extension to the rear. The physiological and morphological laboratories occupy the western end, and the taxonomic laboratories and herbarium the eastern end. The laboratories include a suite of fourteen rooms, giving separate facilities for work in the main divisions of the subject. The equipment includes a supply of the apparatus necessary for research. Microscopes of the most approved patterns of Bausch & Lomb, Leitz, and Zeiss, with batteries of objectives of a wide range, are found to meet the needs of the workers who have used the laboratories to this time. The photographic room contains professional stands with the best anastigmatic lenses of Zeiss, Goerz, and Leitz, projecting and photomicrographic apparatus, field cameras and accessories; space is also afforded for the precision balances of the chemical laboratories. The physiological dark-room is constant to temperatures between 16° and 21°C. The chemical laboratories are as yet only supplied with the more elemental apparatus. The experimental room has an aquatic tank,

is skylighted and has a cemented floor; its contiguity to the other laboratories is a great advantage. A constant temperature room in the basement has been found to furnish a satisfactory thermographic curve, although it has not yet been used in research work.

A compartment in the propagating houses, comprising about a thousand feet of floor space, is equipped for experimental work in connection with the laboratories, and ample space is afforded in the plantations for the same purpose.

It is to be seen that the Garden affords opportunity for research in all of the broader questions of botany, inclusive of climatological influences, acclimatization, history of species, development of races and varieties, hybridization and horticultural practice, development, general morphology, embryology, physiology and environmental relationships in general, and natural affinities of species and groups.

The presence of a number of investigators in different phases of the subject has a most stimulating effect upon the individual student, and the mutual interchange of views does much to counteract the tendency to over-specialization. The number of registered students using the laboratories, library, or herbarium during the past year was twenty-eight, and most of them were graduates of colleges and universities. Botanists from other institutions using the facilities of the institution, for periods from a day to over a month, numbered more than a score.

An especially profitable feature exists in the weekly conventions, at which the worker gives an account of his own results, a review of some recent book or article, or a visiting botanist gives an address upon some subject of general interest. Subjects have been recently presented as follows:

"A Summer's Work at the Royal Herbarium at Kew," by Professor L. M. Underwood.

"Life-history and Development of the Gametophyte of *Schizæa pusilla*," by Mrs. Elizabeth G. Britton and Miss A. Taylor.

"The Genus *Lycopodium*," by Professor F. C. Lloyd.

"Confervæ," by Dr. Tracy Hazen.

"Marine Flora of Bermuda," by Dr. M. A. Howe.

"Some Features of the Flora of the Great Plains," by Professor C. E. Bessey.

"Effect of Low Temperature upon the Growth of *Sterigmatocystis nigra*," by Miss Ada Watterson.

"Plants and Poisons," by Dr. R. H. True.

"Spore Dissemination in the Sordariaceæ," by Dr. David Griffiths.

"Flora of Montana and Yellowstone National Park," by Dr. P. A. Rydberg.

"Anatomy of the Flowers of Certain Grasses," by Mr. G. V. Nash.

"Mycorrhizas of *Monotropa*," by Dr. D. T. MacDougal.

"Embryology of *Viburnum*," by Miss Nellie Hewins.

"Vegetative Reproductions of the Hepaticæ," by Dr. M. A. Howe.

"Substances Isolated from Cocoanuts," by Mr. J. E. Kirkwood.

The following outline shows the special subjects in which investigations may be carried on, together with the name of the person under whose guidance the work may be done. It is to be said, however, that almost any problem in botany may be taken up by trained botanists of sufficient experience who may resort to

the laboratories with the expectation of finding the material facilities for their work. The laboratories never close, and the worker may find here opportunity for work during the summer vacation season.

The guidance of research work is distributed as follows:

Physiology of the Cell—Doctor MacDougal.

Ecology—Professor Lloyd.

Morphology of Algae—Doctor Howe, Doctor Richards.

Morphology of Fungi—Professor Underwood.

Morphology of Bryophyta—Professor Underwood, Mrs. Britton.

Morphology of Pteridophyta—Professor Underwood.

Morphology of Spermatophyta—Doctor Rydberg.

Experimental Morphology—Professor Lloyd, Doctor MacDougal.

Taxonomy of Algae—Doctor Howe.

Taxonomy of Fungi—Professor Underwood.

Taxonomy of Bryophyta—Professor Underwood, Mrs. Britton.

Taxonomy of Pteridophyta—Professor Underwood.

Taxonomy of Spermatophyta—Doctor Britton, Doctor Small, Doctor Rydberg.

Taxonomy of Graminae—Mr. Nash.

Embryology of Spermatophyta—Professor Lloyd.

Special Taxonomy (critical study of a family or genus)—Professor Underwood, Doctor Britton, Doctor Howe, Doctor Small, Doctor Rydberg, Mr. Nash, Mrs. Britton, Professor Burgess.

Regional Botany—Professor Underwood, Doctor Britton.

Physiology of Nutrition—Doctor Richards.

Ecological Physiology—Doctor MacDougal, Doctor Curtis.

Physiological Anatomy—Doctor Curtis.

General Physiology—Doctor MacDougal, Doctor Curtis.

D. T. MACDOUGAL.

### Preliminary Study of Mycetozoa.

As a preliminary to the study of slime moulds, as suggested in the article of T. H. MacBride<sup>(1)</sup>, reviewed in the September number of this JOURNAL, a modification of the method given by Caspar O. Miller<sup>(2)</sup> may be of interest, especially as by it slime moulds in all phases of development can be obtained at any season desired, and in such a form as to be suited to study in the laboratory.

Miller discovered that plasmodia were developed in all cultures made by filling a beaker half full of hay and covering the hay with ordinary tap water. Care must be taken to allow some of the stalks of hay to project above the water, to serve as a support upon which the plasmodia may climb. The beaker was covered with a cotton plug to prevent the dust in the air from entering. The ordinary moulds which appear after a few days were removed with sterilized forceps, care being taken to loosen the under layers of hay, so that some of the

(1) Jour. N. Eng. Bot. Club, 2: 1900.

(2) Quar. Jour. Min. Science, Vol. 41, N. S., p. 43.

stalks always projected above the water. After five or six weeks, plasmodia from several centimeters to several inches in length were seen to spread out upon the surface of the beaker. They seem to prefer the smooth surface of the glass, perhaps because it offers the only large surface above the water upon which the plasmodia can spread. From two to twelve days after their appearance on the glass above the water, the protoplasm collects at one or a number of the points at the periphery of the network and forms sporangia, leaving behind the so-called hypothallus.

Acting upon this suggestion, a series of cultures were made by partly filling beakers with hay, then slipping glass slides between the hay and the surface of the beaker, and adding water until it stood a little above the middle of the slides. Each beaker was covered with a glass plate to prevent too rapid

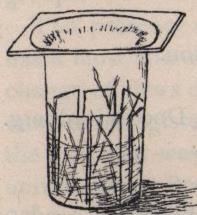


Fig. 1.

evaporation (Fig. 1). The beakers were allowed to stand undisturbed until the plasmodia appeared. During the time, however, the glass plate was removed for an hour each morning, for fear there might otherwise be too great an accumulation of CO<sub>2</sub> in the beaker. But no further precautions were taken. Other cultures of the same hay were prepared every five days, in that way the various stages of development could be studied or compared at any desired time.

It was found that the plasmodia spread as readily upon the glass slide, on the side turned toward the surface of the beaker, as on the beaker itself. At any time, therefore, a slide could be taken from the beaker and studied under the microscope in its undisturbed condition. It is better not to cover the plasmodium with a cover-glass, as it does not live under water, but just at the surface, and either from the pressure of the cover-glass or the excess of water, it is apt to go all to pieces. Very little of the hay infusion need be added from time to time to keep the uncovered plasmodium moist.

A form which was found most suitable to study the streaming movements of the protoplasm developed in cultures made from hay gathered in Aurora, N. Y., during 1898. This same hay is still used in the laboratory, and produces plasmodia as rapidly as it did the first year it was gathered. I have not been able



Fig. 2.

to identify the form illustrated two-thirds its natural size in Fig. 2 and enlarged in Fig. 3. It is of an opaque cream white color and

always forms as figured, with a strong branch just at the surface of the water, sending down secondary branches somewhat smaller in size, which connect by still smaller branches with a very vacuolated network just within the water. Under the microscope the clear hyaloplasm zone and the granular inner zone can be easily distinguished;

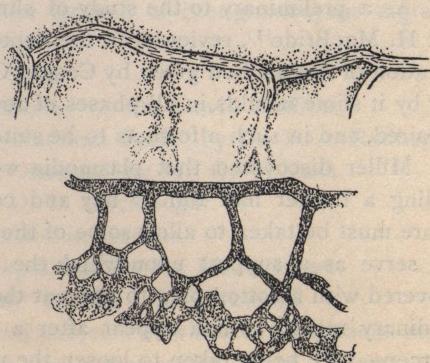


Fig. 3.

also the formation of new branches by the coalescence of the pseudopodia can be observed. It will not be necessary to go into further details, for I have nothing new to add to the general description given in the English edition of DeBary's Comparative Morphology and Biology of Fungi, Mycetozoa, etc. (p. 425); all that is spoken of there can be readily seen and followed. In fact, for laboratory demonstration of the streaming movements of protoplasm to beginners, this plasmodium has proved of far more use than the Amœba or the other objects usually used, as Chara tips, Tradescantia hairs, etc.; because, being macroscopic in size, you waste no time finding it, and not having any very dense cell walls, at the ends of the network at least, the motion of the protoplasm can be clearly seen; besides, being able to put one's hands on it any time one wishes is not the least of its advantages.

If the water is allowed to evaporate, the course of the plasmodium, following the surface of the water, can be easily traced by the "envelope" of DeBary, or the "hypothallus" of Miller, which remains behind, and the outlines of which are accentuated by the refuse gathered around it, as shown in Fig. 3.

Permanent mounts of plasmodia may be made by plunging the slides upon which they are spread into strong alcohol, or a solution of picric acid in strong alcohol. The alcohol seems to be necessary to coagulate the albuminous substances, and so fix the plasmodium to the slide at the same time that it is killed. If aqueous killing fluids are used, such as picro-sulphuric or corrosive acetic, a considerable evolution of gas is seen to arise from the plasmodium (probably  $\text{CO}_2$  from the  $\text{CaCO}_3$ ), and sooner or later it floats down from the slide, and it is difficult to successfully remount it. With the alcohol the most delicate threads remain intact. The slides may then be transferred to some aqueous stain (Grübler's haematoxylin gave good results), and if desired the stain may be differentiated with acid alcohol without harm. The vacuolated structure of the protoplasm is very beautifully shown, but it is difficult to distinguish between nuclei, ingested food particles, or refuse composed of unicellular organisms, bacteria, etc., which sticks all over the plasmodium. This last difficulty might be largely obviated, I should think, if Miller's directions on the Aseptic Cultivation, etc., were carefully followed. Bacteria, according to Miller, are always present, but they would be easily distinguished.

CLARA LANGENBECK.

Wells College.

## MICRO-CHEMICAL ANALYSIS.

### X.

#### POTASSIUM—Continued.

##### *VI. With Stannic Chloride.*

The hydrated stannic chloride is employed, since this hydrated salt is much more easily handled than the anhydrous liquid compound  $\text{SnCl}_4$ . In the hydrated salts  $\text{SnCl}_4 \cdot x\text{H}_2\text{O}$ ,  $x$  may be either 3, 5, or 8. All three of these salts are crystalline, and are to be referred to the monoclinic system.

When stannic chloride is added to quite concentrated solutions of potassium

salts, slightly acidified with hydrochloric acid, beautiful, large, colorless, octahedral crystals of the compound  $K_2SnCl_6$  sometimes separate. Generally the conditions which obtain are such that owing to the solubility of the potassium stannic salt, nothing is seen until the test drop has evaporated almost to dryness, or until alcohol is added.

There seems to be some doubt as to whether we should call this salt a true chlorstannate or a double salt of the formula  $2KCl \cdot SnCl_4$ . If it is true that we have chlorplatinic acid in solutions of platinum chloride, by analogy we can consider that in the case of the potassium-tin compound we have to do with a salt of chlorstannic acid. Moreover, the similarity of the chlorstannates of K, Rb, Cs, and  $NH_4$  to the chlorplatinates of these elements is very striking.

Properly speaking, stannic chloride is not a suitable reagent for potassium, since the salt formed is too soluble. This reagent is, however, one of our most valuable salts for the detection of cesium (*q. v.*).

The chlorstannates of ammonium, rubidium and cesium (and thallium) are far more insoluble than the potassium salt.

#### VII. With Cerous Sulphate.

Cerous sulphate added to solutions of salts of potassium acidified with sulphuric acid, gives rise to the formation of potassium cerous sulphate.

The reagent is most easily obtained in the form of the ceric oxide, and can be kept for use in this state. It can be brought into the proper condition for use by being treated as follows: Place a small drop of sulphuric acid on platinum foil, add a little of the oxide, and heat until most of the acid has been driven off. Add more acid and heat again. This treatment should produce a product almost completely soluble in water. Add a drop or two of hydrogen peroxide, and warm the preparation; the solution being acid, the  $H_2O_2$  acts as a reducing agent, and a clear, colorless liquid results. Evaporate, and then dissolve in sufficient water to make a dilute solution.

A drop of a solution of the reagent is allowed to flow into a drop of that of the substance to be tested. Both drops must be dilute. The preparation is warmed very gently at the zone of union. The salt  $K_2SO_4 \cdot Ce_2(SO_4)_3 \cdot 2H_2O$  rapidly separates as very minute, more or less spherical masses. When the solutions are sufficiently dilute, or if the preparation is allowed to evaporate spontaneously, tiny but well formed colorless hexagonal plates are obtained (Fig. 34 B).

Sodium treated in the same way gives, as has already been stated under the head of this element, very small lenticular and fusiform crystals, and dumb-bell-

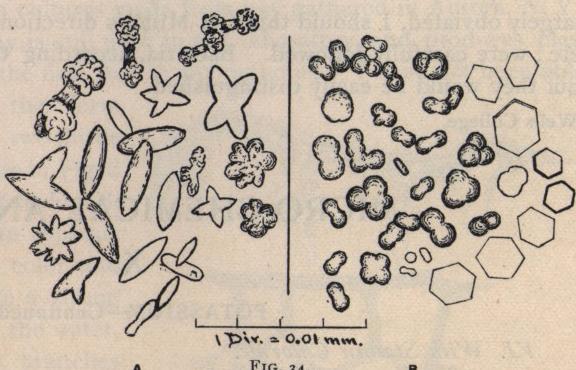


FIG. 34.

like aggregates (Fig. 34 A). Rarely, tiny four-sided prisms, with pyramidal ends, are formed.

If a sufficiently high power is employed, there is generally no difficulty in distinguishing the double salt of potassium from that of sodium.

Owing to the fact that higher powers must be employed than is usual in micro-chemical work, it is necessary that the drop be spread out in a thin layer, it being impossible to examine a well-rounded deep drop. The usefulness of the test is therefore restricted.

#### *VIII. With Sodium-Cobalt Nitrite.*

This reagent produces, in neutral solutions of potassium salts or solutions acidified with acetic acid, a very difficultly soluble double nitrite of potassium and cobalt of the formula  $3\text{KNO}_2 \cdot \text{Co}(\text{NO}_2)_3$ .

It is greatly to be regretted that this interesting and delicate reaction can seldom be made to yield more than very minute globular grains. While it is a convenient and generally reliable reaction for potassium in ordinary qualitative analysis in the wet way, it is not to be recommended for micro-chemical testing.

Either the standard reagent, all prepared, can be employed, or what is perhaps more convenient for our purposes, the sodium nitrite, is added to the neutral test drop and a solution of cobalt acetate, weakly acidified with acetic acid, is allowed to flow in. The formation of yellow spheroids, octahedra, or the skeletons of octahedra, will indicate the presence of potassium, providing that ammonium, rubidium, and cesium are absent, these elements giving an identical reaction.

#### *IX. With Sodium Tartrate or Tartaric Acid.*

The reaction taking place can be expressed as follows :  $\text{KCl} + \text{HNaC}_4\text{H}_4\text{O}_6 = \text{HKC}_4\text{H}_4\text{O}_6 + \text{NaCl}$ . Since the product of the reaction, primary potassium tartrate (potassium bi-tartrate), requires a neutral or only slightly acid solution, and is, moreover, fairly soluble, it is convenient to proceed as follows : Evaporate

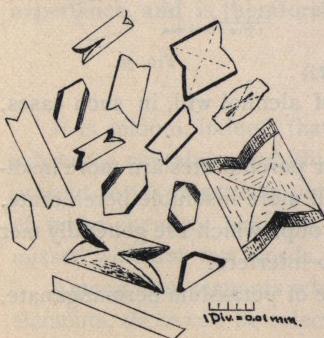


FIG. 35.

the test drop so as to obtain a thin uniform film of material. Place, near by, a drop of water into which introduce a little tartaric acid and a slightly greater quantity of sodium tartrate, stir until all has dissolved; then draw the reagent thus prepared across the film of substance. If no crystals appear after a short time, add a drop of weak alcohol. The potassium salt separates as transparent, highly refractive prisms. The crystal forms are quite varied, those most frequently obtained are shown in Fig. 35. Primary potassium tartrate crystallizes in the orthorhombic

system, and exhibits a great tendency to assume hemihedral and skeleton forms.

Tartaric acid alone can be employed with good results, but primary sodium tartrate is better. The addition of the free acid suggested above is for the purpose of assuring the presence of the primary compound.

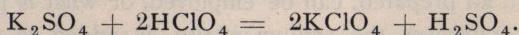
Rubidium and cesium give an identical reaction, their primary tartrates being even more insoluble than that of potassium, hence the salts of these two elements will separate first. In fact, this last property can be utilized for detecting rubidium or cesium in the presence of potassium, if a sufficiently dilute solution be employed.

Ammonium sometimes gives crystals not to be distinguished from those of potassium; at other times, when treated as above, the precipitate is distinctly different.

Many other elements yield relatively insoluble tartrates, which, while differing from the potassium salt, yet resemble it sufficiently to lead to confusion (see Calcium and Strontium).

Double tartrates are also apt to be formed. This is far more liable to happen when large drops are employed and the reagent added at once to the test drop, than when evaporation to dryness is practiced, and the reagent then drawn across.

*X. Perchloric acid added to solutions of salts of potassium precipitates\* Potassium Perchlorate.*



*Method.*—Next to the dilute solution of the substance to be tested place a tiny drop of water, and to the latter add a drop of perchloric acid or a little ammonium perchlorate. Cause the drop of the reagent to flow into the drop to be tested. In a few seconds colorless, highly refractive, clear cut crystals of potassium perchlorate separate (see Fig. 36). These crystals belong to the orthorhombic system, but at first sight those first formed seem to be isometric, while later, what would be mistaken for monoclinic prisms appear.

*Remarks.*—The solutions must be dilute, otherwise the potassium perchlorate is precipitated at once.

If the solution is too dilute, crystals may not appear for a considerable period. The addition of alcohol will, in such cases, greatly hasten matters.

Rubidium and cesium give a like reaction; their perchlorates are more insoluble than that of potassium. Thallium forms a still more insoluble perchlorate.

The perchlorates of the elements of the other groups which are generally met with in ordinary work, are sufficiently soluble not to interfere.

Behrens\* has recently shown that in the presence of potassium permanganate, the perchlorate of rubidium is colored pink.

Advantage can be taken of a similar property of the potassium salt to obtain an exceedingly beautiful test, for if the test drop contains sodium permanganate, the potassium perchlorate separating therefrom will be colored. To obtain this reaction, add to the test drop a little sodium manganate, so as to impart a dis-

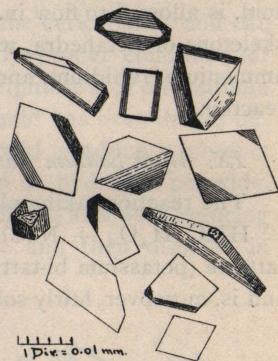


FIG. 36.

\* van Breukeleven, Rec. trav. chim. Pays-Bas. XVII, 1, 94.

tinct green, then add a tiny drop of hydrochloric acid, thus converting the manganate into permanganate. The reagent is then allowed to flow in. The crystals of potassium perchlorate which separate have the same form as before, but are a beautiful deep rose color, the intensity varying with the amount of permanganate present. In a few moments the liquid is completely decolorized, and the precipitated crystals deeply colored. Performed in this way the test is an elegant and very striking one.

#### *Exercises for Practice.*

Try reaction with different salts of potassium.

Introduce sodium permanganate into the test drop, and test as above.

Try the reaction on the other members of Group I.

Make a mixture of K and Na salts. Treat a drop of a solution of this material with perchloric acid, evaporate, treat with the reagent again, and again evaporate, extract the dry residue with alcohol, and test the alcoholic extract for sodium.

Try the action of perchloric acid on members of the magnesium group, and the calcium group.

#### *XI. Ammonium Fluosilicate.*

As performed in the ordinary manner, with solutions of moderate concentration, no separation of crystals results. It is only under unusual conditions, or by evaporation, that potassium fluosilicate can be made to appear. From a practical standpoint, therefore, this reagent is without value for the detection of potassium. The salt  $K_2SiF_6$  crystallizes as cubes, octahedra, and combinations of these forms.

#### *XII. Conversion into Sulphate, Double Sulphates, etc.*

The remarks made under Sodium, with reference to a similar method, apply with equal force to potassium. This method requires too much care and great experience, and is therefore impracticable save for the expert crystallographer.

### RUBIDIUM AND CESIUM.

It is seldom, indeed, that the chemist is called upon to make tests upon a substance containing rubidium or cesium. For this reason, and also because the present series of articles purports to give merely an introduction to the methods of micro-chemical analysis, these elements can be discussed together and dismissed with but few words.

Among the reagents which can be employed for the detection of these two elements, three can be selected as being the most satisfactory.

- I. Potassium Chlorplatinate.
- II. Ammonium Silicomolybdate.
- III. Stannic Chloride.

Of these, I and II serve for the detection of both rubidium and cesium, and III for cesium alone.

### I. Potassium Chlorplatinate.

Since the chlorplatinates of rubidium and cesium are so much more insoluble than that of potassium, it is more convenient to employ a saturated solution of the potassium salt than to make use of a solution of chlorplatinic acid. The employment of this salt renders it possible to test for the two elements under consideration even in the presence of salts of potassium and ammonium.

Allow a drop of a saturated solution of potassium chlorplatinate to flow into a drop of a *dilute* solution of the material to be tested. The test drop should be neutral or only slightly acid with hydrochloric acid (see Potassium, Method I). If cesium is present its chlorplatinate separates immediately as exceedingly minute crystals of the same form as those of the potassium salt. The crystals are always so small that a high power is required to enable one to ascertain that the precipitate is not an amorphous one. Rubidium chlorplatinate being a trifle more soluble, separates later in crystals again of the same form, but at least twice as large, though still much smaller than those of the corresponding potassium compound.



FIG. 37.

If the solution to be tested is not exceedingly dilute, skeleton crystals almost invariably result, resembling crosses or 5- and 6-pointed stars; careful focusing will reveal with the latter the fact that the branches of the stars do not lie in one plane, but are arranged in the three dimensions of space corresponding to the axes of an octahedron. In the case of rubidium, these skeleton forms often attain a considerable size.

The usual forms assumed by rubidium chlorplatinate have been sketched in Fig. 37. The crystal forms given by the cesium salt are the same, but much smaller.

### Exercises for Practice.

Try the reaction of chlorplatinic acid on dilute, and on concentrated solutions of K, NH<sub>4</sub>, Rb, Cs.

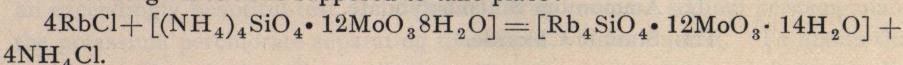
Repeat the experiments in the presence of considerable free sulphuric acid.

Try, as directed under Rubidium and Cesium, the action of potassium chlorplatinate on these two elements. Then try on solutions of K salts and of NH<sub>4</sub> salts.

Make a mixture of Rb and Cs, and attempt to decide upon the presence of both elements. Then try a mixture of NH<sub>4</sub> and Rb, and one of NH<sub>4</sub> and Cs.

### II. Ammonium Silicomolybdate.

This reagent, which can be prepared according to the method given in a previous article\*, forms very insoluble compounds with rubidium and cesium. The following reaction is supposed to take place:



\* Jour. App. Micro., Vol. III, 821.

As in the case of the phosphomolybdates (see Potassium IV), the composition of the silicomolybdates is still in doubt.

When the following method is employed, there is generally no difficulty in distinguishing between rubidium and cesium. A drop of an *exceedingly dilute* solution of the substance is spread out in a thin layer, and evaporated in the usual manner. A drop of a dilute solution of ammonium silicomolybdate containing a trace of free nitric acid is drawn across the dry film and the slide held

inclined for a second or two, placed on the stage of the microscope, and a tiny drop of a saturated solution of the reagent added to the reagent drop on the slide. The rubidium salt separates at once along the edges of the streak of reagent in the form of lemon-yellow, highly refractive cubes, octahedra, dodecahedra, and the usual combinations of these forms, often rapidly passing into spheroidal granules (Fig. 38). In size these crystals approximate those of rubidium chlorplatinate.

When cesium is present, and the test is thus performed, the cesium salt is instantly precipitated in the form of grains so minute that even a high power fails to reveal any definite form other than what appear to be minute disks. The solubility of the cesium salt is therefore so far below that of the corresponding rubidium compound, that there is little difficulty in distinguishing between them even when both are present in the same substance. So delicate is the reaction that it is essential that there be only the smallest possible amount of these two elements present.

It is advisable to have no salts of ammonium present, since these compounds seem to lower the solubility of the reagent sufficiently, at times, to cause the appearance of octahedra of ammonium silicomolybdate. According to Ladenberg\* the octahedra of ammonium silicomolybdate act feebly on polarized light, and hence are not to be referred to the isometric system.

Potassium salts treated in the above manner give after a time, near the edges, neat prisms, which under favorable conditions may attain a considerable size. These crystals are far too soluble, and their form so different from the rubidium compound that it is impossible for them to be mistaken for the latter.

Silver, thallous, and mercurous salts are also precipitated by this reagent. Sodium and lithium yield no crystals; the same is true of the magnesium and the calcium groups.

Better crystals of rubidium silicomolybdate can be obtained by the addition of a dilute solution of the reagent to a dilute solution of the rubidium compound than by the method suggested above, but this process does not permit of so easily distinguishing between rubidium and cesium.

#### *Exercises for Practice.*

Try the above method on salts of Na, K, Rb, Cs,  $\text{NH}_4$ , Li.

Test mixtures of K and Rb; K and Cs;  $\text{NH}_4$  and Rb;  $\text{NH}_4$  and Cs; Rb and Cs; K, Rb, and Cs.

\*Handwörterbuch, VII, 361.

Make a mixture of Na, K, Ca, and a trace of Rb, and test. Repeat the last experiment, after having introduced Cs.

### *III. Stannic Chloride.*

Solutions of stannic chloride added to hydrochloric acid solutions of cesium salts give rise, even in dilute solutions, to the precipitation of cesium chlorstannate  $\text{Cs}_2\text{SnCl}_6$ .

In order to avoid the possible interference of other salts, it is advisable to first convert the substance to be tested into the form of a chloride by repeatedly evaporating with hydrochloric acid.

Place near a drop of the moderately dilute solution of the substance, previously acidified with hydrochloric acid, a drop of a concentrated solution of the reagent, also acidified with hydrochloric acid. Cause the drops to unite. Cesium chlorstannate is almost immediately precipitated as colorless transparent crystals. The usual forms obtained are the cube, octahedron, and combinations of the two. In fact, crystal forms identical with those spoken of in the discussion of potassium chlorplatinate (q. v.). Fig. 29 will, therefore, also represent the appearance of these crystals.

Ammonium salts must first be removed by gentle ignition, since ammonium chlorstannate is a salt of almost as low solubility as that of the corresponding cesium compound.

The chlorstannates of potassium and rubidium are much more soluble than that of cesium, hence there is little danger of their separating from dilute solutions. If, however, the solution employed has not been of sufficient dilution, the rubidium salt  $\text{Rb}_2\text{SnCl}_6$  will first separate in forms identical with those of the cesium salt, but of slightly larger size, then after a time, when the drop has evaporated sufficiently, the potassium salt  $\text{K}_2\text{SnCl}_6$  will also appear in yet larger crystals.

If iron is present in any considerable amount the crystals of cesium chlorstannate which separate are generally colored yellow.

The sodium salt  $\text{Na}_2\text{SnCl}_6 \cdot 5\text{H}_2\text{O}$  is too soluble to separate under the conditions which obtain in the test. The same is true of the chlorstannates of the calcium group.

In cases where no crystals of the cesium salt appear after some time, a little sodium iodide can be added, thus inducing the formation of cesium iodostannate, which is considerably less soluble than the chlorstannate. Cesium iodostannate appears as tiny lemon or orange-yellow octahedra.

In the place of stannic chloride, the chlorides of the closely related elements, antimony and bismuth, can be employed, either with or without the addition of sodium iodide. Thus, chlor- or iodo- antimonates or bismuthates are obtained. The iodo- compounds thus produced yield very beautiful reactions.

### *Exercises for Practice.*

To chlorides, in HCl solution, of Na, K, Rb, Cs,  $\text{NH}_4$ , add stannic chloride, first trying the reaction on concentrated, then on dilute solutions.

Make a mixture of K and Cs, test. Then try one of Rb and Cs.

Try the reaction of chlorides of bismuth and of antimony on cesium chloride.

## Easy Method of Mounting and Preserving Mosquitos.

The present impetus given to malarial investigation requires the collection and identification of these insects, and it is of importance that scientists and physicians in this country should collect and identify such specimens as they can obtain in their immediate vicinity, and more especially if malarial fever is known to be present and *proved microscopically*. The calling of any and all diseases malarial, or coupling them to typhoid or pneumonia, is to be discouraged, and all physicians should have a positive blood test before treating or calling a case such.

Papers concerning this work will be found in *British Medical Journal* No. 2054, May 12, 1900, pp. 1183-1188; No. 2060, June 23, 1900; and in Prof. Adam's Report on Tropical and Subtropical Diseases of Canada, p. 1544.

A pamphlet on "How to Collect Mosquitos" has been issued by the Montreal Natural History Society, and edited I believe from the British Museum. The insects must be carefully pinned out or preserved, or they are injured in shipping. The method used by Dr. D. C. Rees, in the London Tropical School, is as follows:

- (1) Kill in ordinary killing bottle, or chloroform, or tobacco.
- (2) When dead turn specimen on its back, separate legs, place large drop of thick xylol balsam on slide, invert this gently on to the mosquito so as to pick it up and not injure.
- (3) With fine needle spread and arrange wings and legs, and if necessary press thorax down *gently*.
- (4) Pour on thin xylol balsam and straighten the antennæ and proboscis as it runs out.
- (5) Set aside to harden; chip off excess.
- (6) Place a glass ring about  $\frac{1}{16}$  to  $\frac{1}{2}$  inch deep over specimen, and fill up the chamber thus formed with balsam, the upper surface of which should be convex, so that when cover is applied no air bubbles are included.
- (7) Let it harden, and then mail if desired.

N. B.—If glass rings are not handy, balsam alone will do. (I use zinc carpet rings.) If desired to photograph the insect, its parts must lie as nearly in one plane as possible. This method is due to Dr. G. D. Freer, Colonial Surgeon, Penang Hospital.—*B. M. J.*, p. 1468.

Dr. John Reid, Redhill, Surrey, Eng., adds a note in regard to above. In place of killing aphides, mosquitos, etc., coax them to get entangled in a drop of glycerin, and with fine needles put in best position. Chemistry explains how glycerol menstrum exhibits structure better than balsam, which refuses absolutely to mix with aqueous media. Care and patience are required to prevent injury and air bubbles. Glycerol jelly may be used if preferred, and the insects die in more natural positions than in balsam.—*B. M. J.*, p. 1592.

In reply to both, I prefer the carbolic acid method, or if desired carbolic and glycerol, which I published some years ago. Glycerin is not always to be relied on, especially if any chitinous or limy deposits are present.

Journal of  
**Applied Microscopy**  
 and  
 Laboratory Methods.

Edited by L. B. ELLIOTT.

Issued Monthly from the Publication Department  
 of the Bausch & Lomb Optical Co.,  
 Rochester, N. Y.

SUBSCRIPTIONS:

One Dollar per Year. To Foreign Countries, \$1.25  
 per Year, in Advance.

The majority of our subscribers dislike to have their files broken in case they fail to remit at the expiration of their paid subscription. We therefore assume that no interruption in the series is desired, unless notice to discontinue is sent.

demonstration, just as the microscope has been elevated from the function of a toy to that of the biologist's right hand assistant.

The camera, popularly employed for recreation, now supplies one of the readiest, most useful and reliable means for illustration and the recording of facts and conditions.

The stereopticon has advanced from the companionship of children to the control of the lecture room.

The countryside with its ponds and ditches, once the exclusive territory of the naturalist, sneered at by the section cutter, is again sought by biologists, and without a knowledge of the life of its denizens his work is balked.

So through the list the index points to a JOURNAL OF APPLIED MICROSCOPY AND LABORATORY METHODS in which the microscope shall be the principal subject and the related methods be given their proper share of consideration. In this decision our contributors and friends to whom the matter was first referred have unanimously agreed. It is not proposed to lessen the amount of material devoted to the microscope, but rather to give an additional number of pages each month, printed on a finer grade of paper suitable for the illustrations required.

\* \* \*

Beginning with this number, Mr. Raymond Pearl, Zoölogical Laboratory, University of Michigan, will conduct a department of General Physiology, which will be devoted to the reviewing of current literature in the field of general physiology, using the term in its broadest sense. No attempt will be made to keep abreast of the enormous literature of medical physiology as ordinarily defined, but we shall rather have to do with that physiology which treats of the life phenomena of all organisms. A special feature will be made of the topics of animal reactions and behavior which are now exciting such general interest. The effort will be made to give practical accounts of all new methods of work along the lines indicated, especially such as can be used by teachers in secondary schools or colleges in demonstrating to classes.

WITH the beginning of our fourth volume the scope of the JOURNAL is broadened so as to include general laboratory methods in those branches of science and industry in which the microscope is used.

The microscope is the central figure around which a host of contributory subjects group themselves, and a record of microscopical progress is, to the worker, incomplete and of comparatively little value without a record of developments in the accessory processes upon which his work depends. To-day the museum is transformed from a curiosity shop to a substantial aid in

## CURRENT BOTANICAL LITERATURE.

CHARLES J. CHAMBERLAIN.

Books for review and separates of papers on botanical subjects should be sent to  
Charles J. Chamberlain, University of Chicago,  
Chicago, Ill.

## REVIEWS.

**Goebel, K.** Organographie der Pflanzen insbesondere der Archegoniaten und Samenpflanzen, Zweiter Teil. Specielle Organographie. 8vo, pp. xiii-xvi + 385-648; 173 illustrations. Gustav Fischer, Jena. M. T.

tations of the Pteridophytes, and with the sporophyte generation of the Spermatophytes. The gametophyte of the Pteridophytes is discussed under the headings (1) Structure and Development of Sex Organs and (2) The Form of the Prothallia.

In treating the development of antheridia the author advances views which are at variance not only with the views of Belajeff and others, but also with his own previous accounts. According to his present interpretation we have within the microspore wall of *Isætes* a prothallium, consisting of three sterile cells and one antheridium, the wall being represented only by the cover cell. In treating the development of antheridia and archegonia, the transition from free to imbedded forms is described in some detail. The peculiar prothallia of *Ophioglossum*, *Botrychium*, and *Lycopodium*, receive particular attention. In the second part of the book, which is devoted to the sporophyte generation of the Pteridophytes and Spermatophytes, the various organs are discussed in great detail. Some of the most interesting topics are: The Comparative Morphology of the Embryo; The Transition Between Leaf and Shoot; Leaf Formation; The Relation between Leaf Venation and Leaf Development; Transformed Leaves; Branching, etc. The treatment throughout is dominated by experimental morphology, and cannot fail to be a great help to all investigators, and especially to those who are too rigid in their morphology. While constantly calling attention to the variation which occurs in nature, and which may be induced artificially, the author also recognizes the large part which heredity plays in determining the plant form. An English translation will appear soon.

C. J. C.

**Byxbee, Edith S.** The Development of the Karyokinetic Spindle in the Pollen-mother-Cells of *Lavatera*. Proc. Cal. Acad. Sci., Ser. III, Bot. 2: 63-82, pls. 10-13, 1900.

Miss Byxbee's work on *Lavatera* is an addition to the very interesting series of contributions on spindle formation

recently issued from the laboratory of the University of California. While differing in certain minor details, the writer's conclusions confirm the more important points previously observed in *Cobaea*, *Passiflora*, *Gladiolus*, etc., by other investigators. Her observations are briefly as follows: The meshes of the network, close to the nuclear wall, form a felt of fibers about the nucleus. The granular constituent of the cytoplasm collects in a wide, dense zone about the nucleus.

The linin increases in quantity, the nuclear wall breaks down, and the fibers outside begin to grow into the nuclear cavity. The cytoplasmic and linin fibers form a mass in which the chromosomes lie. The mass of fibers projects out at a number of points, forming the multipolar spindle. Two of the cones become more prominent than the others, which they finally absorb, thereby forming the bipolar spindle. Just how this absorption of the cones is brought about is not made clear either in the description or in the figures. Flemming's strong solution of chrom-osmo-acetic acid was used almost exclusively as a fixing agent, but fair results were also obtained with palladium chloride and iridium chloride to which a small amount of glacial acetic acid had been added. Of the stains used the safranin-gentian-violet-orange G. combination gave the best results. The paper is well illustrated by four beautiful lithographic plates.

Chicago.

A. A. LAWSON.

**Timberlake, H. G.** The Development and Function of the Cell Plate in Higher Plants. *Bot. Gaz.* 30: 73-99, 154-170, pls. 8-9, 1900.

This work was undertaken to determine in detail the exact sequence of events during the division of the cell body, and to correlate, as far as possible, the facts thus brought out from the point of view of the physiology of cell reproduction. The formation of new radiating fibers around the daughter nuclei in the diaster stage, and the formation of a spindle around a single chromosome, as described by Juel for *Hemerocallis*, are taken to indicate that the chromatin is the real center for the formation of kinoplasmic fibers. Having formed as fibers around the nucleus as a center, the kinoplasm takes part in the process of nuclear division, and later divides the cell by a part of the fibers being transformed into a membrane which becomes, in splitting, the plasma membranes of the daughter cells. Prior to the formation of the cell plate the equatorial zone becomes filled with a substance which stains strongly with the orange of the triple stain. The similarity in staining of this substance, together with its presence in the region of the spindle in which the cell wall appears later, is taken to signify the presence of a carbohydrate substance destined for the formation of the new cell wall. The relation of the carbohydrate material to the process of division would seem to show that the substance for the formation of the cell wall is held in a reserve form in the protoplasm before it is actually needed for the process of wall formation. If the relation of the carbohydrate material to the spindle fibers be taken in connection with the facts shown by Klebs and Townsend, that the presence of a nucleus is necessary for the formation of a cell wall, there would be some evidence for the hypothesis that the nucleus forms the cell wall substance.

The material used for investigation was *Allium cepa*, *Lilium longiflorum*, *Fritillaria imperialis*, *Hyacinthus orientalis*, *Vicia faba*, *Phaseolus vulgaris*, *Pisum sativum*, *Larix Americana*, *Larix Europaea*, *Iris versicolor*, and *Hemerocallis fulva*. Several fixing fluids were employed: Flemming's chrom-osmo-acetic acid; Hermann's platinum chlorid-chrom-acetic acid; Vom Rath's platinum chlorid-picro-osmo-acetic acid; Keiser's mercuric chlorid-acetic-acid, etc. Of these methods the material fixed in Flemming's stronger solution gave the best results. The triple stain, safranin-gentian-violet-orange, was used to stain the material fixed in fluids containing osmic acid, while Zimmermann's fuchsin iodin green and

Heidenhain's hæmatoxylin, preceded by Bordeau red as a ground stain, were used to stain material fixed in the fluids containing mercuric chlorid. The paper is poorly illustrated by a series of reproductions of photographs. While photography is a convincing method of illustrating points in gross histology, it has so far proved a failure as a means of illustrating protoplasmic structures within the cell. Lithographic drawings, or even diagrams, are much more satisfactory. The work is a valuable contribution, as it adds much to our knowledge of the origin and function of the cell plate.

A. A. LAWSON.

Chicago.

**Wager, H.** The Eye Spot of *Euglena viridis*. This paper gives us an interesting account of investigations on the struc-

Jour. Linn. Soc., 27: 463-481, 1900.  
ture and behavior of *Euglena viridis*. On the general structure of *Euglena*, Mr. Wager gives nothing new, merely summarizing what is already known, but he reports a striking feature in the vacuole system, namely, that the gullet is in permanent connection with the principal vacuole or "excretory reservoir," as he calls it. The eye spot he believes to be derived from chlorophyll, because the action of its granules when in alcohol shows the same behavior as do the rusty, red granules of Fucaceæ, which are known to be derived from chlorophyll. His most interesting discoveries were on the flagellum and its relation to the eye spot. He found, by the use of osmic acid, that the flagellum passed into and was attached to the excretory reservoir instead of terminating in the gullet. The base of the flagellum is bifurcate, and on one of the limbs, in close (but not organic) connection with the concave side of the eye spot, is a large oval swelling or enlargement. Quoting Englemann's experiments on the behavior of *Euglena* in a spectrum, he notes that the greatest gathering of the Euglenæ is in the blue end. Since the red pigment of the eye spot allows the blue rays of normal light to pass, he suggests, tentatively, that there is possibly a definite stimulus exerted by the blue rays upon the swelling, and hence on the flagellum. The other hypothesis which he brings forward is that the eye spot merely causes a definitely unequal illumination of the sensory spot, and orientation follows. Further experiments along that line would prove interesting.

Chicago.

P. G. WRIGHTSON.

## CYTOTOLOGY, EMBRYOLOGY, AND MICROSCOPICAL METHODS.

AGNES M. CLAYPOLE.

Separates of papers and books on animal biology should be sent for review to  
Agnes M. Claypole, Sage College,  
Ithaca, N. Y.

### CURRENT LITERATURE.

- Furst, C. M.** Haarzellen und Flimmerzellen. Anat. Anz. 18: 190-203, 1900. (6 figs. in text.) This investigation was carried out to show definitely the resemblances and differences between the so-called "hair-cell" and the ciliated cell. The material used was principally embryonic

salmon. It was fixed in Perenyi's fluid and stained in Heidenhain's haematoxylin and Orange G. Especially careful study was made of hair-cells from the crista and macula acoustica. In a salmon embryo of 150 days every cell from this region has a black staining layer on its upper border, against the lymph space. Next inside to stain is a similarly staining cone with a clearly marked apex reaching down toward the nucleus. The hair-cell complete, possesses an internal point or hair which can clearly be shown to be formed of cilia fastened together; a basal layer shown by iron haematoxylin to be composed of deeply staining round bodies; and a cone continued into the cell and staining deeply. This whole series of parts, the hair, the layer, the cone, forms a definite organ, the "hair apparatus or organ." The different parts of this organ correspond to the special parts of the ciliated cell, the cilia, the basal bodies, the ciliary cone; as if it were a specialized or modified ciliated cell. The hair cell is, due to the "hair organ," a specific form of cell which keeps the principal morphological features of the ciliated cell. Probably this "hair apparatus" is the sensory organ of the cell. The opponents of the Lenhossek-Henneguy hypothesis, concerning the origin of the basal bodies from the centrosome, have not yet deprived that theory of its probability.

A. M. C.

**Heidenhain, M.** Ueber die erste Entstehung der Schleimpföpfe beim Oberflächenepithel des Magens. Anat. Anz. 18: 417-425 (4 abb.), 1900.

It is customary to see the surface epithelium of the stomach with its cells full of mucous, a condition true of all animals from fishes upward throughout the vertebrate series. In view of this fact special interest was aroused by finding the epithelial cells in the stomach of a full grown specimen of *Triton tenuis* contain only a small quantity of mucous. The mucous free cells showed on the free surface a striated border similar to the well known "brush-border" described by Tovnier in different glandular epithelia. In all these preparations the brush-borders show clearly in the cells of the stomach glands, but in spite of the great resemblance of the structures it is doubtful whether the border of fine protoplasmic hairs of the surface epithelium is identical with the "brush-border" of gland cells. However, the term will still be used in this article.

It is evident that the width of the border varies in different cells and the striated border shows still more differences. The origin of the mucous plug commonly seen in cells is by the pouring out of the mucous substance between the rods of the brush-border, by which means the border increases in width with an increase in the amount of mucous poured out. In this way forms the convex mucous "goblet" without the direct participation of the original protoplasmic cell body. These preparations were stained in iron haematoxylin and rubin, the haematoxylin being bleached until it remained only in the nucleus centrosome and granules of glandular secretion; the protoplasm stained solely by the rubin.

Very instructive preparations were obtained from a specimen of *Triton tenuis* which showed a larger quantity of mucous. The brush-borders stand in a close relation to the mucous and to the formation of the well known mucous plug of the surface epithelium. Black-tinted protoplasmic threads rise from the surface of the cell and are here thickened into root-like processes; these latter

show no particular regularity of form. These "roots" are connected at the inner limit of the border by protoplasmic fibres. At their free ends the little rods swell to fine irregular knots, a condition not observed for the brush-borders. Between the rods lies the mucous which may be aided in its separation by them. At first the surface of the cell is flat, but with the increasing amount of mucous it becomes more and more arched until the familiar beaker-cell is formed, the fine striations still remaining visible on its outer border and sending plasmic threads downward. When this form has been obtained the cell-body, hitherto free from mucous, shows a large drop which appears below the striated border. The whole presents a curious appearance. In the layer of mucous coming from the cell-protoplasm are seen many fine protoplasmic columns. These support on their outer ends many branches looking like candelabra, the original rods of the brush-border. Continuing, the formation of mucous causes first the destruction of the protoplasmic columns, leaving the branches only. Then these too disappear, leaving the mucous clear and unlined. These thickened "roots" of the rods in these mucous cells are not to be compared with the basal pieces of ciliated epithelium. The controsome lies in these cells within the mucous.

The special reason for publishing these observations in such detail is a recent article by A. Gurwitsch (review in JOURNAL OF APPLIED MICROSCOPY, iii, 805, 1900), on the development of ciliated cells. According to his observations, the earliest stages show a border of purely alveolar structure and later on the full surface of the border is a fine protoplasmic network. These, according to the present writer, are both impossible. The distal thickenings observed by Heidenhain account for the distal network.

A. M. C.

**Barrows, A. S.** Respiration of *Desmognathus*. The views already advanced to account for respiration in lungless salamanders, of which this forms a type, claim extensive "buccopharyngeal" respiration, excluding the skin from an important part in respiration. The discovery later of blood vessels in certain lunged forms that reached to the pharyngeal epithelium supported this view. It has been shown for *Speleotes fuscus*, a lungless form, that there is a similar nearness to the surface of the pharyngeal capillaries. In the work done on *Desmognathus fusca* a warm carmin injection mass was introduced through the ventricle of the heart by means of a hypodermic syringe. A remarkable net-work of capillaries was found to extend through the entire wall of the esophagus. These were found to be from the arteriæ maxillares externæ on the dorsal wall and of the arteriæ pharygeæ on the ventral wall. On each side the arteriæ pulmonales anastomosing with the arteriæ gastrica send branches to the esophagus. The blood is collected especially in the venæ esophagæ. A more complete consideration will follow this preliminary paper.

A. M. C.

**Stassano, H.** Function of the Nucleus. Compt. Rend. 1, 30: 1780-1783, 1900. (Review in Jour. Roy. Micr. Soc. pt. 5, 1900.)

The author finds cells of the vascular endothelium manifest a strong affinity for mercury and other poisons introduced into the circulation, and believes that this is effected by the nucleus by virtue of its nucleins, which form compounds with metals and bases analogous

to salts. His evidence is under five heads: 1. Leucocytes, which are very rich in nuclein, show a strong affinity for metals. 2. In young dogs the endothelial cells contain granulations shown by Kowalewsky to present the characters of nuclear granulations. Organs of these young dogs absorb more mercury by weight than those of older dogs in which the granules are absent. 3. It has been shown that the amount of nuclein in an organ depends on the number of cell nuclei present, and the author's experiments show that the amount of mercury absorbed depends on the amount of nuclein present. 4. The non-nucleated red-blood corpuscles of mammals are the only cellular elements that do not absorb mercury. 5. An intravenous injection of methyl-violet reduces the absorption of mercury by the cells of the vascular endothelium. With this may be compared the fact that cells treated with such substances as osmic acid do not stain. The affinity of the nucleus for basic stains is itself a proof of the author's view.

A. M. C.

## RECENT LITERATURE.

- Aichel, Otto.** Vergleichende Entwicklungs geschichte und Stammesgeschichte der Nebennieren. Ueber ein neues normales organ des Menschen und der Säugethiere. 3 Taf. 1 fig. Arch. f. Mikrosk. Anat. u. Entwicklungsgesch. **56:** 1-80, 1900.
- Grosser, O.** Mikroskopische injectionen mit Eiweiß-Tusche. Zeitschr. f. wiss. Mikrosk. **17:** 178-181, 1900.
- Marcus, H.** Zur "intravitalen" Neutralroth färbung der Leukocyten. Wiener klin. Wochenschr. **13:** 871-873, 1900.
- Mühlmann, M.** Atrophie und Entwicklung. Deutsche med. Wochenschr. **26:** 655-657, 1900.
- Plato, J.** Ueber die "vitale" Färbbarkeit der Phagocyten des Menschen und einiger Säu gethiere mit Neutralroth. 1 Taf. Arch. f. Mikrosk. Anat. u. Entwicklungsgesch. **56:** 868-917, 1900.
- Doflein, F.** Studien zur Naturgeschichte der Protozoon. iv. Zur Morphologie und Physiologie der Kern- und Zelltheilung. Nach Untersuchungen an Noctiluca und anderen Organismen. Zool. Jahrb. Abtheil f. Anat. u. Ontog. v. Thiere. **14:** 1-60, 1900.
- Phisalix-Picot.** Recherches embryologiques, histologiques et physiologiques sur les glandes à venin de la salamandre terrestre. Thèse de doctorat en. méd. Paris, 1900.
- Brunn, Max von.** Zur Histologie der Epithelien der serösen Häute. 2 fig. Centralbl. f. Allg. Pathol. u. pathol. Anat. **II:** 604-607, 1900.
- Reinke, Johannes.** Die Entwicklung der Naturwissenschaften, insbesondere der Biologie, im neunzehnten Jahrhundert. (Rede zur Feier des Jahrhundertmechsels am 13 Jan., 1900, Zu Kiel.) Kiel. Univ.-Buchh. 1900 (215).

## NORMAL AND PATHOLOGICAL HISTOLOGY.

RICHARD M. PEARCE, M. D.

University of Pa., Philadelphia, Pa., to whom all books and papers on these subjects should be sent for review.

**Nichols, E. H.** On the Etiology of Cancer. First Annual Report of the Cancer Investigation Committee to the Surgical Department of the Harvard Medical School. Journal of the Boston Society of Medical Sciences. Vol. V, No. 2, 1900.

cause of cancer were constantly present.

2. The inoculation of animals with portions of tissue from fresh cancer.
3. The inoculation of animals with the blastomycetes of Sanfelice and Plimmer.

Nichols investigated this subject along four lines:

1. A histological study of tumors in order to determine whether the characteristic bodies claimed to be the

**4. Attempts to isolate parasitic micro-organisms from malignant tumors.**

*First.* In the histological study tissues were hardened in alcohols of various strengths, Hermann's solution, Flemming's solution, corrosive sublimate, and Zenker's fluid. Zenker's fluid gave the best results. Paraffin imbedding was used.

For staining, the methods recommended by Sanfelice and Plimmer were tried at first, but as they did not give satisfactory results, the following method suggested by Mallory was used :

1. Ten per cent. aq. sol. ferric chloride, two minutes.
2. Aq. sol. haematoxylin (1-2 per cent.), freshly made, two minutes.
3. Wash in water.
4. One per cent. sol. ferric chloride until blue color is removed from protoplasm and nuclear stain is distinct. (Watch under microscope.)
5. Wash in water.
6. In the following solution for two minutes.  
    1 per cent. aq. sol. acid fuchsin, one part.  
    Sat. aq. sol. picric acid, two parts.
7. Wash in water.
8. Ninety-five per cent. alcohol.
9. Xylool, three changes, blotting between each change.
10. Mount in Xylool balsam.

This stain colors nuclei black, protoplasm a faint greenish pink, and connective tissue a brilliant red. The peripheral and central portions of inclusions stain a brilliant red, the intermediate portion a faint pink.

The stain is simple in manipulation, constant and even in its results.

Thirty-five carcinomata and five sarcomata were examined. In seventeen cases, bodies similar to those described by Sanfelice and Plimmer were found. They were found principally in cancer of the breast, in thirteen out of sixteen cases. They were never found in epidermoid cancer (thirteen cases) nor in sarcoma (five cases).

Although the writer makes no definite negative statement, he apparently believes that these bodies have nothing to do with the causation of cancer.

*Second.* Inoculations were made from tumors which were received within two hours after operation, and which were not ulcerated. Under aseptic precautions portions of tumor were removed and placed in the peritoneal cavity of a rabbit and a guinea-pig. In all, nine rabbits and three guinea-pigs were inoculated, chiefly with tissues from cancer of the breast. All inoculations were negative.

*Third.* Subcutaneous and intraperitoneal inoculations and injections into ear vein, liver, and anterior chamber of the eye of rabbits and of guinea-pigs, of the "Saccharomyces neoformans" of Sanfelice and the micro-organism of Plimmer produced only inflammatory and proliferative changes. No tissue resembling cancer was produced.

*Fourth.* Cultures were made from thirteen cases. In three, pyogenic cocci grew, the other ten remained sterile.

The writer states that his work is not yet completed; and he therefore cannot give definite conclusions. The results so far, however, have been definitely negative.

R. M. P.

**Greenough, R. B.** On the Presence of the So-called "Plimmer's Bodies" in Carcinoma. Journal of the Boston Society of Medical Sciences. Vol. V, No. 2, 1900.

In this work Greenough examined twenty-three carcinomata of the breast. The tissue was preserved in Zenker's or Hermann's fluid, the former giving

the best results. Sections were stained according to Plimmer's directions with iron haematoxylin and counterstained with either Orange G and fuchsin or with Bordeaux red.

#### Conclusions :

1. The appearances known as "Plimmer's bodies" were found in each of twenty-three cases of breast cancer.
2. They were more numerous in the periphery of the tumors and in the metastases.
3. They were not found in areas which had undergone even slight degeneration, whether before or after removal.
4. They were more numerous in the slow growing carcinomata, and less frequently found in the rapid growing ones.
5. They were more numerous in scirrhous than in medullary or adeno-carcinoma types of cancer.
6. They were not found in three cases of epithelioma (one of which was a typical Paget's disease of the breast).
7. They were present in one case of ovarian cancer and absent in another case of general peritoneal cancer, of probable ovarian origin.

R. M. P.

## GENERAL PHYSIOLOGY.

RAYMOND PEARL.

Books and papers for review should be sent to Raymond Pearl, Zoological Laboratory, University of Michigan, Ann Arbor, Mich.

**Parker, G. H., and Burnett, F. L.** The Reactions of Planarians, with and without Eyes, to Light. Amer. Jour. Physiol. 4: 373-385, 1900.

This paper gives an account of a study with very exact methods of the reactions to light of normal planarians as compared with specimens from which the eyes had been removed.

The species used was *Planaria gonocephala* Dugès. The method employed was such as to admit of an exact statistical treatment of the problem, and is on that account very valuable. In detail it was as follows: A planarian was placed in a shallow rectangular glass dish containing water to a depth of about one centimeter. After the animal had begun to creep along the bottom, the dish was placed on a black board on which was inscribed a circle 55 millimeters in diameter. This circle was divided into quadrants by mutually perpendicular diameters, and the arc of each quadrant was further divided by short cross lines into intervals of ten degrees. "These lines were designated in degrees, the one at the end of one of

the diameters being taken as zero, and those in the semicircles to the right and to the left of this zero being numbered in corresponding series till they met at  $180^{\circ}$ ." The dish containing the animal was placed over this circle in such a way as to bring the center of the animal over the center of the circle, and its head directed towards the zero point on the circumference. The apparatus was set up in a dark chamber in order to exclude extraneous light, and the illumination for the experiment was obtained from a Welsbach burner placed at a constant distance from the center of the circle. The heat rays were absorbed by an alum solution contained in a parallel-sided glass vessel, which was placed between the light and the dish containing the animal. The light was made to enter horizontally only, or, by the use of a screen and reflector, vertically from above. The anterior end of the animal and zero point of the circle were towards the source of light entering horizontally in one set of experiments, and away from it in another set, while in a third the light entered from above. For one series the eyes were removed by cutting off the head with a sharp scalpel. In each experiment the animal was observed from the time it left the center till it crossed the circumference of the circle. Its path was marked free-hand on a circle which was a duplicate of the one on the black board, and later measured in millimeters. The angle on the circumference at which the animal crossed was read directly, and the time taken in the passage from center to circumference was obtained by means of a stop-watch.

This method, with modifications to suit particular cases, will undoubtedly prove very valuable in work in phototaxis. Exact records can be obtained of the angle of deviation in the path caused by light coming from one direction; of the form of the path taken and the distance travelled; and of the rate of travel under constant light stimulation. The principal result of the investigation was to show that planarians, with or without eyes, when moving *horizontally towards* a source of light are more deflected from an ideal course (to zero on the scale) than when moving under a vertical light, and conversely, when moving *horizontally away* from a source of light they keep nearer to an ideal course. The animals without eyes are affected by light in the same way as those with eyes, but their reaction is less precise. The rate of movement of the decapitated animals is slower than that of the normal. The reactions are believed to be due to a dermatoptic function.

R. P.

**Matthews, A. P.** Some Ways of Causing Mitotic Division in Unfertilized Arbacia Eggs. Amer. Jour. Physiol. 4: 343-347, 1900.

Several new methods are given in addition to those which have already been described for producing cell division in the sea urchin egg. Lack of oxygen is first discussed. Unfertilized Arbacia eggs were placed in an Engelmann gas chamber in sea water, and hydrogen gas, carefully freed from acid, was passed through the preparation. After twenty to thirty minutes' exposure to the hydrogen, oxygen was admitted for ten minutes, and then again hydrogen was allowed to act for twenty minutes. The eggs were then transferred to fresh sea water, and in a comparatively short time clear areas appeared in the cytoplasm, and division into from two to eight cells took place. Continuous exposure to hydrogen kills the eggs before any segmentation occurs. Eggs which have been too long exposed immediately liquify completely

when oxygen is admitted. Warming the eggs to 32° or 33° C. for from two to four minutes causes the clear areas to appear, and segmentation to occur, after the return to sea water of ordinary temperature. Segmentation is also caused by exposing the eggs to the action of sea water in which either ether, or alcohol, or chloroform has been dissolved. In all cases division did not occur until the eggs were brought back into ordinary sea water. In his theoretical conclusions, drawn from these experiments, the author is inclined to abandon his earlier view that karyokinesis is allied to the process of blood clotting, and states that he believes "that whatever the details of the process may prove to be, the essential basis of karyokinetic cell division is the production of localized areas of liquefaction in the protoplasm." In view of the great ease with which *Arbacia* eggs can be made to segment by a variety of stimuli of different physical and chemical character, such a broad generalization, having as a basis the phenomena shown by these eggs under a particular set of conditions, seems to be of uncertain value.

R. P.

**Carlgren, O.** Ueber die Einwirkung des constanten galvanischen Stromes auf niedere Organismen. Arch. Anat. u. Physiol. Abth., 1899, pp. 49-76, 1 Taf.

Ueber die Einwirkung u. s. w.: Zweite Mitt. Versuche an Verschiedenen Entwicklungsstadien einiger Evertebraten. Ibid, 1900, pp. 465-480.

The first of these papers makes a noteworthy advance in our knowledge of the effect of the constant current on organisms, since it demonstrates the importance of the kataphoric, or so-called "osmotic" action of the current.

It is principally given to an account of the electrotactic response of *Volvox*. The sense of the reaction is at first kathodic, but later changes to anodic. Striking changes in the form of the body are produced by the current. The anode side of the colony becomes crumpled, while the kathode side is correspondingly swollen out. The parthenogonidia move to the anode side of the colony. These changes in body forms and movements of the parthenogonidia are entirely passive phenomena, the anode crumpling and kathode swelling occurring in colonies which have been killed in formalin in the same way as in living specimens. Various Protozoa killed in weak formalin or ether solution show the same changes in form under the action of the current. Carlgren concludes that the purely physical, kataphoric action which produces these results is of very great significance as a factor in the effect of the current on organisms.

In the second paper descriptions are given of the electrotactic responses of a number of marine invertebrates. The point of most general interest is in regard to the reactions of the larvæ of certain echinoderms (*Strongylocentrotus lividus*, *Spherechinus granularis*, *Ophiothrix fragilis*, and *Asteracanthion glacialis*). Young, free-swimming stages of these forms gave no response whatever, while older larvæ, Plutei and Bipennariæ, became oriented and went to the kathode. Theoretical discussion of the results is left for a later paper. No new methods of work are described.

R. P.

**Warren, E.** On the Reaction of *Daphnia magna* (Straus) to Certain Changes in its Environment. Q. J. Mic. Sci. N. S. 43: 199-224, 1900.

It was found that the time of killing in solutions of NaCl of

The experiments described in this paper have to do with the effect on *Daphnia* of certain changes in the con-

different strengths (.8 per cent. to 6.0 per cent.) seems to depend quite exactly on the number of molecules of salt which strike the animal in a unit of time. The relation of time of killing and strength of solution is represented by the rectangular hyperbola  $y(x-8)=277$ . An increase in temperature causes the molecules to move faster and strike with greater momentum, and hence the time of killing is reduced in high temperatures. The physiological condition of the animal is a most important factor in determining its power of resistance to NaCl. Perhaps the most striking result of the investigation is that animals which have become acclimatised to a .25 per cent. salt solution show less resistance capacity than do normal, unacclimatised specimens, to solutions of greater concentrations. The author thinks that this is probably due to some constitutional weakness resulting from the acclimatising process. *Daphnia* living in a confined volume of water were shown to have shorter caudal spines, and to reproduce less vigorously than those that had lived in an unlimited bulk. Water in which *Daphnia* has lived for some time has a poisonous effect on individuals from other cultures. This paper is of interest in connection with the recent work of Miss Enteman (Amer. Nat. 34: 879-890) on the extreme variability of a related species *Daphnia hyalina* under differing natural environmental conditions.

R. P.

## CURRENT BACTERIOLOGICAL LITERATURE.

H. W. CONN.

Separates of papers and books on bacteriology should be sent for review to  
H. W. Conn, Wesleyan University, Middletown, Conn.

**Flexner.** The Etiology of Tropical Dysentery. The author has made an extensive series of studies of dysentery occurring in the Philippines, and comes to the conclusion that dysentery is of two distinct types. One, the chronic form, is accompanied by the presence of amœbæ in the intestines in large quantities, and is, therefore, what has been called amebic dysentery. The other, the acute form, is not accompanied by these protozoa, and appears to be produced by bacteria. The author finds universally present in these cases, a bacillus which he describes and with which he experiments. This bacillus is pathogenic for small animals, producing symptoms quite similar to those of dysentery, and is believed by the author to be unquestionably the cause of acute dysentery in eastern countries. The organism is identical with that isolated by Shiga from the epidemic of dysentery prevailing in Japan. Flexner regards this cause of dysentery as widely distributed in nature.

H. W. C.

**Ritchie.** The Bacteriology of Bronchitis. The author makes a bacteriological study of a number of cases of bronchitis. In most instances they were made by post mortem examinations, and were bacteriological studies of the lung tissue. Numerous bacteria are found in the lungs under the circumstances, most of which, as would be expected, have nothing to do with the disease. The general conclusion of the author is as

follows: Acute bronchitis is an infective disease but not due to any specific organism. Various bacteria are found in the secretions, some of which are the exciting causes of the disease. The disease is more often due to a mixed infection than to the action of bacteria. The most important causal bacteria are the *Diphtheria pneumoniae* and streptococci. The author also believes that the influenza bacillus is not, infectionally, the cause of bronchitis, independent of the ordinary form of influenza.

H. W. C.

**Moore, Veranus A., B. S., M. D.** Professor of Comparative Pathology and Bacteriology, New York State Veterinary College, and of Bacteriology, Cornell University Medical College, Ithaca, N. Y. An Introduction to Practical Bacteriology for Students and Practitioners of Comparative and Human Medicine. Second edition, enlarged and revised. Boston, U. S. A., Ginn & Co., Publishers. The Athenæum Press, 1900.

twice the former size. The new chapters are on the morphology of the coccus forms, bacilli and spirilla, a study of *Pseudomonas pyocyaneus*, of *Bacillus tetani*, and of the bacteria of the healthy mouth. The appendix contains a reprint of the method of determining the reaction of the culture media recommended by the committee of the American Public Health Association in 1897, together with brief directions for inoculation experiments on animals. All of the exercises are exceedingly practical and practicable, the directions are concise while being sufficiently explicit, and references to standard literature lead the student to extend his knowledge by consulting the authorities in the science. The selection of exercises amply justifies the title of the book.

University of Rochester.

CHARLES WRIGHT DODGE.

**Hall, H. O.** The Etiology of Scarlet Fever. The feature of this paper consists in a New York Medical Record, 56: 697, 1899. study of the geographical distribution of scarlet fever and its relation to the use of milk as a food. The author finds that the disease occurs in all countries where cow's milk is an important article of diet, especially for children. It is lacking, however, in those countries where cow's milk is not used. In China and Japan, where cow's milk is not used as food, the disease is unknown. In India, where cow's milk is used for adults but not for children, the disease is extremely rare. In countries where asses' milk or goat's milk is used, scarlet fever is unknown. The author is of the opinion that this is a disease primarily distributed by milk.

H. W. C.

**Courmant.** L'agglutination der bacille de Koch des epanchements tuberculeux. Arch. de Med. Exp. 12: 697, 1900.

culous animals. He finds that the exudations of tuberculous animals always produce an agglutination of the bacillus, but that the amount of agglutination is not proportioned to the extent of the disease. Advanced cases of the disease produce little agglutination, while incipient cases produce a very marked effect. The author believes that the phenomenon may be of a decided diagnostic value.

The author has studied the problem of the agglutination of the tubercle bacillus by the various exudations from tuber-

If the serous exudations of a suspected individual produce an agglutination, it indicates the presence of the disease. The absence of the reaction, however, does not necessarily indicate the absence of the disease, for advanced cases produce no reaction. The agglutinative power of the seral exudations is greater than that of the blood of the same animal, and, hence, the author concludes that the power of agglutination is developed in the exudations, and are not simply a phenomenon transferred from the blood.

H. W. C.

**Rogers.** Schutzimpfung gegen Rinderpest. The experiments here mentioned Zeit. f. Hyg. u. Infek. 21: 59, 1900. describe a long series of investigations upon the value of the method of inoculating against rinderpest. The author experiments not only with the method of Koch, but with two or three other methods that have recently been devised. His general conclusion is that inoculation by the gall method produces an immunity in cattle against this disease, but that the immunity is quite fleeting, lasting only about four months. He finds, further, that different classes of cattle behave quite differently towards this inoculating test. Mountain cattle and lowland cattle are very different in their sensitiveness to immunization and to the disease. The former are not easily immunized by the gall method. Of the several methods used the author believes that some are best for certain breeds of cattle, and others for other breeds of cattle. The paper hardly admits of summary.

H. W. C.

**Saul.** Beiträge zur Morphologie des Staphylococcus albus. Berl. Klin. Woch., p. 1058. 1900.

makes his studies in gelatin plates inoculated in such a way that each plate contained only one or two colonies, and preserved under conditions to retain their moisture so that the colonies could continue growing for months. The gelatin, with the contained colony, was hardened and sectioned, and careful studies made of the sections. Some excellent figures are given of the colonies. The important conclusion is that the colonies are not simply irregular aggregates of cells, but appear to be units, and should be regarded, therefore, rather as "cell states" than as irregular aggregations. The colonies, though varying widely in form, are always reducible to a fundamental type which appears to be based upon the principle of dichotomous branching.

H. W. C.

**Trommsdorff.** Ueber Gewöhnung von Bakterien an Alexin. Arch. f. Hyg. 39: 31, 1900.

pointed out that micro-organisms, when transferred from one medium to another, commonly suffer some injurious influence, and for a time fail to increase,—or may even decrease. It has been suggested, therefore, that diminution of bacteria in freshly drawn blood is due to the change from bouillon culture to blood, and not to any poisonous alexin. The author tests this theory by cultivating the typhoid cholera bacteria in the blood and serum of animals whose blood is inactive by heat at 56° for one hour. After cultivation in this inactive blood the bacteria are inoculated in active blood, and are found to be just as rapidly killed

The evidence for a germicidal action of freshly drawn blood has been, in recent years, subject to criticism. It has been

by the fresh blood as they are in a control test when they are taken directly from bouillon. To determine whether the bacilli could adapt themselves to the alexins in the active blood, Trommsdorff cultivated the organism in fresh blood. After being cultivated in this active blood for a time, they were transferred to fresh active blood, and were found to suffer no diminution in numbers. He found, further, that organisms thus adapted to the alexins of the ordinary blood are checked in their growth if transferred to a pleuralexuadite which has the alexins present in larger quantities than ordinary blood. He concluded, therefore, that bacilli quickly adapt themselves to the alexins in the blood.

H. W. C.

## NOTES ON RECENT MINERALOGICAL LITERATURE.

ALFRED J. MOSES AND LEA McI. LUQUER.

Books and reprints for review should be sent to Alfred J. Moses, Columbia University, New York, N. Y.

**Friedel, G.** Nouveaux essais sur les Zeolites (Suite 1). Bull. Soc. Min. 22: 84, 1899. *Natrolite (Mesotype).* Author treats of the manner in which water is expelled during heating, and gives a plate showing dehydration curves. Concludes that all the water of natrolite is of the same nature ("zeolitic"). L. McI. L.

**Pratt, J. H.** On the Separation of Alumina from Molten Magmas, and the Formation of Corundum. Am. Jour. Sci. iv, 8: 227, 1899. Author treats of the differentiation of igneous magmas upon cooling, and of the genesis of minerals. The separation of corundum from molten magmas is "dependent upon the composition of the chemical compounds that are the basis of the magma; upon the oxides that are dissolved with the alumina in the magma, and upon the amount of alumina itself." L. McI. L.

**Ward, H. L.** New Meteorite from Murphy, Cherokee Co., N. C. Am. Jour. Sci. iv, 8: 225, 1899. Neuman lines noted, also the presence of troilite and daubreelite. L. McI. L.

### INDIVIDUAL SPECIES.

**Calcites** (Siliceous) from the Bad Lands, Washington Co., So. Dakota. S. L. Penfield and W. E. Ford. Am. Jour. Sci. iv, 9: 352, 1900. The specimens resemble in character the Fountainbleau limestone, and are gray in color. They consist of about 40 per cent. of calcite, enclosing 60 per cent. of quartz sand. The crystals occur singly, but more often in groups, and evidently have formed in a stratified deposit of sand, representing a phase of sand cementation with the crystalline form of the calcite preserved. The crystal forms are steep hexagonal pyramids of the second order (rare in calcite), which are somewhat barrel-shaped, with rounded ends. The Fountainbleau crystals show the acute rhombohedron  $f(0221)$ .

L. McI. L.

**Quartz.** Sur un groupe de cristaux de quartz de Striegan (silésie). F. Gonnard. Bull. Soc. Min. 22: 92, 1899.

noticed, of which three [(13.0. 13.1), (5051), (2577)] are probably new, one being a new plagiobhedron.

L. McI. L.

**Quartz.** Etude cristallographique du quartz des géodes des marnes oxfordiennes de Meylan (Isère). F. Gonnard. Bull. Soc. Min. 22: 94, 1899.

number of new or rare forms. Tabulation of these forms given. Liquid inclusions with air bubbles also noticed, and the fissuring of the crystals, sometimes observed, is thought to be due to the expansion of this liquid.

L. McI. L.

**Stokesite.** A. Hutchinson. Phil. Mag., Nov., 1899, p. 480. Description from a single crystal (10 mm. long) in Cambridge Mineralogical

Museum. Orthorhombic, with forms  $b$  (010) and  $v$  (121).  $a:b:c=0.3479:1:0.8117$ . Cleavage perfect, parallel to  $b$ , and also good parallel to prism, taken as unite; fracture, conchoidal; H.=6—6.5; G.=3.185; lustre, vitreous, pearly on  $b$ ; colorless. Partial chemical examination determines it as a hydrated silicate of Na and Ca, with about 6 per cent. of tin oxide, replacing part of the  $\text{SiO}_2$ .

L. McI. L.

## Medical Notes.

**NOTE ON EXAMINATION OF BLOOD.**—A microscopical examination of the stained specimen of pathological blood implies a comparison with the appearance of normal blood when subjected to the same straining process. The experienced observer unconsciously makes use of his mental picture of the normal specimen in doing this work, and to him it is sufficient. In fixing and staining blood spreads, however, a slight variation in technique may produce a decided difference in results, consequently those who have had comparatively little experience in such work will find it difficult to secure uniform results without a considerable laboratory equipment. In preparing pathological specimens in such cases a spread of normal blood may, at the same time, be subjected to the same technique and mounted on the slide with the pathological specimen, making exact and reliable comparison a very easy matter. Dried blood spreads can be kept indefinitely, so a supply of normal specimens can easily be kept constantly in readiness for use.

W. A. FULTON, M. D.

Burlington, Wis.

**Kober.** The Presence of Diphtheria Bacilli in the Mouths of Healthy Individuals. Zeit. f. Hyg. 31: 433.

which were supposedly not so exposed. The investigations included microscopical study, cultivation upon serum, and inoculation of guinea pigs. Of the 128 cases,

The group consists of three crystals with vertical axes parallel, and peculiar arrangement of faces. Eight forms are

Quartz occurs in clear, pellucid bi-pyramids, modified by very small prism faces, and also showing a large num-

ber of new or rare forms. Tabulation of these forms given. Liquid inclusions with air bubbles also noticed, and the fissuring of the crystals, sometimes ob-

served, is thought to be due to the expansion of this liquid.

L. McI. L.

Museum. Orthorhombic, with forms  $b$  (010) and  $v$  (121).  $a:b:c=0.3479:1:0.8117$ . Cleavage perfect, parallel to  $b$ , and also good parallel to prism, taken as unite; fracture, conchoidal; H.=6—6.5; G.=3.185; lustre, vitreous, pearly on  $b$ ; colorless. Partial chemical examination determines it as a hydrated silicate of Na and Ca, with about 6 per cent. of tin oxide, replacing part of the  $\text{SiO}_2$ .

L. McI. L.

L. McI. L.

Examinations were made in 128 cases which were known to have been exposed to diphtheria, and in 600 cases

only 10, or about 8 per cent., gave evidence of infection; while of the 600 cases, but 15, or 2.5 per cent., showed the presence of bacilli, and 10 of these later gave evidence of having been previously exposed, thus greatly reducing the percentage in the last experiment. It is generally estimated that diphtheria bacilli are found in the mouths of about 18 per cent. of all healthy individuals. The results above cited would indicate that this per cent. is very much too high.

C. W. J.

**May, Richard.** The Use of Orcein in the Demonstration of Elastic Fibres in the Sputum.  
Deut. Archiv. f. Klin. Med. 68: 427.

The sputum is thoroughly mixed with an equal amount of 10 per cent. caustic potash solution, care being exercised that no more heat is used than is needed to dissolve the sputum. When thoroughly dissolved, centrifugalize and pour off the liquid portion. Add to the sediment about 2 c. c. of Unna-Tanzer's orcein solution, the composition of which is as follows:

Orcein,	1.0
Alcohol, absolute,	80.0
Water, dist.,	40.0
HCl, conc.,	40.0

This solution has a red color, which changes to violet when the solution comes in contact with the potash of the sediment. The original color is regained by adding three to five drops of HCl.

Place the centrifuge tube in boiling water for three to five minutes, as heat is necessary to hasten the staining process. Hydrochloric acid alcohol is then added, and after gently shaking the solution, it is centrifugalized by a few turns of the machine; the same process being repeated twice with fresh acid alcohol. The formula for the hydrochloric acid alcohol decolorizing solution is as follows:

Hydrochloric acid, conc.,	5.0
Alcohol, 95 per cent.,	1000.0
Water, dist.,	250.0

**Malkes, J.** Estimation of Mercury in Urine.  
Chem. Zeit. 35: 816, 1900.

500 c. c. of urine are mixed with 5 c. c. of egg albumin and 15 drops of acetic acid, and heated for fifteen minutes on the water bath. The mixture is poured into a beaker, allowed to settle, and the deposit collected in a filter. The paper and its contents are laid on a porous tile for a few minutes. The precipitate is removed to a small cylinder and covered with 50 c. c. strong HCl, a spiral of Cu being immersed in the liquid. After about fourteen hours all the Hg has amalgamated with the Cu, and the acid is dark in color. The wire is washed with water, alcohol, and ether, then dried, after which it is dropped into a tube 5 mm. in diameter with a crystal of iodin, and heated until the sublimate of  $\text{HgI}_2$  appears on the wall of the tube. The amount of mercury is compared with that produced by a ring obtained in the same manner from a urine to which a known quantity of  $\text{HgCl}_2$  has been added.

C. W. J.

## NEWS AND NOTES.

Mr. F. B. Kilmer gives the following report of the December meeting of the New Brunswick Society :

Under the reports of sections, Dr. Henry R. Baldwin announced that experiments were being made with luminous bacteria.

Prof. F. C. Van Dyck explained a new application of the microscope to ascertain the tensile strength of metals.

The President, F. B. Kilmer, delivered a paper entitled "A Study of Cotton," which was illustrated by lantern slides and by slides under the microscope. He showed that cotton fibre had been in use in some form since very ancient times; that while the principal use for cotton fibre is the manufacture of thread and cloth, in recent years many new and important uses have been devised. It forms a component part of the high explosives which are known as gun cotton, smokeless powder, tonite, blasting gelatin, etc. In the form of nitrated cotton, which is soluble in certain liquids, varnishes and lacquers for metal, paper, wood and cloth, imitation leather and silk, substitutes for India rubber and gutta percha are manufactured. Materials of this character made of cotton were exhibited by the speaker. A modern application for cotton is its use as a dressing for wounds.

Cotton for surgical purposes is known as absorbent cotton, which means that the oil, wax and varnish-like coating of the fibre have been removed, and the fibre thereupon absorbs water and other liquids.

The speaker explained the minute structure of a cotton fibre, and while this appeared to the naked eye as a solid cylindrical hair, under the microscope it was found to be a more or less collapsed tube with an outer sheath and an inner opening to the center of the tube. This sheath was associated with a varnish or oily substance and the whole permeated with wax and coloring matter. He stated that while this was the accepted construction of the fibre, he had reason to believe there was much yet to be learned, and slides were exhibited to show that the structure was very complex. A number of slides showed the cotton plant in the various stages of growth; its cultivation, picking and preparation for the market and shipping. Among the slides were those which gave the typical cotton staples of the world.

---

The second annual meeting of the Society of American Bacteriologists was held in the Pathological Laboratory of Johns Hopkins University on December 27 and 28. A full programme of papers was presented and four sessions of the society were held. The society elected Prof. W. H. Welch of Johns Hopkins University as its president for the year 1901. Information concerning the society may be obtained by writing the secretary, H. W. Conn, Middletown, Ct.

---

METHODS IN GERMINATION OF SPORES.—The hanging drop culture is undoubtedly the most convenient method of observing spore germination. It is desirable to employ large rings, which should be cemented to the glass slips by a

mixture of refined beeswax and pure vaseline. The cover should be cemented to the ring with vaseline. The same character of liquid should be used at the bottom of the cell as employed in the drop.

This form of cell culture, although highly accurate for culturable forms in nutrient media, will not give best results when a careful study is to be made of particular stimulants in water, or in a medium not ordinarily causing abundant germination. Any volatile or soluble substance besides the medium employed is apt to reduce the trustworthiness of the results. Even the purest vaseline may have an effect on sensitive forms. As a modification of the above method, the cells may be used in Petri dishes, on the bottom of which is placed filter paper with holes for the insertion of cells, thus securing them against movement. The covers are laid on without vaseline and the whole kept in moist chambers. Petri dishes with ground glass tops are preferable.

A decoction of green string beans or of sugar beet is recommended as the best culture medium for most readily culturable fungi; 392 grams of green beans per liter of water, or about 50 grams of dry matter per liter, have been found satisfactory proportions.

As a standard nutrient salt solution, the following formula is well known. It may be used without the sugar, the osmotic influence being neglected as of little consequence in comparison with the desirability of having equivalent salt constituents :

Ammonium nitrate	- - - - -	1.0 gram.
Acid potassic phosphate	- - - - -	0.5 "
Magnesium sulphate	- - - - -	0.25 "
Iron	- - - - -	trace.
Cane sugar	- - - - -	3 to 5 grams.
Water	- - - - -	100 c. c.

We shall be very glad to have our readers avail themselves of the opportunity which we have previously offered in the JOURNAL and as herein suggested by Dr. Bessey.

Waterville, Me., January 13, 1901.

*Journal of Applied Microscopy :*

SIRS :—I note that you asked your patrons to suggest anything that might occur to them as of interest in making the JOURNAL more interesting. It occurs to me that if you should set apart a column giving the subscribers a chance to ask questions of a scientific nature, and have them answered, either by the editors or by other subscribers, that it might add to the general interest. I think almost any person having laboratory work would like to ask some question that is not in publication, and could be answered by another doing such work. I merely suggest this. Very likely you have already considered it.

Most sincerely yours,

M. W. BESSEY, M. D.,  
Instructor in Zoölogy.

Colby College.

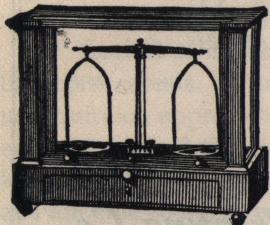


Send for Illustrated Catalogue of  
**Astronomical Telescopes**  
Manufactured by  
**W. & D. Mogeay,**  
Observatory Place, Bayonne City, N. J.

**COLLEGE OF PHYSICIANS AND SURGEONS.**

Equal privileges for Men and Women. Allowance for service in Hospital and Dispensary. Nineteenth year opens SEPTEMBER 20. AUGUSTUS P. CLARKE, A. M., M. D., Dean, 517 Shawmut Avenue, Boston, Mass. Send for Catalogue.

Established 1859.

**HERMAN KOHLBUSCH, SR.**

Manufacturer of  
**Fine Balances**  
and Weights

For every purpose  
where accuracy is  
required.

Send for Illustrated catalogue

59 Nassau St., cor. Maiden Lane, NEW YORK CITY.

**THE SCOTT COLLECTION OF MICROSCOPICAL MATERIAL**

Contains 50 packages of Diatoms, Foraminifera, Polycystines, Spicules, Crystals, Marines, rare and beautiful Seeds, Leaves, Pollens, Sections and Hairs, including curious and rare double hairs of Ornithorhynchus paradoxus, found only in Australia. Material ready for mounting. No trash. Just the thing for colleges and students, as well as for more advanced Microscopists. Customers highly pleased. Collection will not be broken. No circulars. The complete collection mailed for One Dollar. Address, ETTA G. SCOTT, 16 Broad St., Room 72, New York, N. Y. (Out of town checks must be made for \$1.10 to cover cost of collection.)

**Marine Biological Laboratory SUPPLY DEPARTMENT.**

**Preserved Material** of all types of animals for class work or for the museum. For price list and all information address GEO. M. GRAY, Curator, Woods Hole, Mass.

I am prepared to make Microscopic Slides, Photomicrographs, and Lantern Slides. Full satisfaction guaranteed.

Telephone, 2010 Madison Square.  
Office Hours, 1:30 to 5:30.

JAMES H. STEBBINS, Jr., Ph. D.,  
80 Madison Ave., NEW YORK CITY.

**LANTERN SLIDE PLATES**

Our dry plates give results which in brilliancy and transparency of high lights rival the wet plate. Special prices to colleges in case lots.

AMERICAN LANTERN SLIDE CO., Rochester, N. Y.

**POISON****POISON****CHEMICALS**

Our stock of analytical and other chemicals is drawn from the best American and foreign manufacturers, and is complete for almost every requirement. It will pay you to send to us for an estimate on your next order.

**CHEMICAL APPARATUS**

Superior quality and lowest market prices. We have equipped many of the largest laboratories.

**BAUSCH & LOMB OPTICAL CO.,**  
ROCHESTER, N. Y.

**POISON****POISON****URINE AND BLOOD ANALYSIS IN THREE MINUTES****THREE MINUTES**

New Booklet giving all Methods, Phosphates, Sulphates, Chlorides, ALBUMIN, Bacteria, Etc., mailed free.

**A NEW CATALOGUE OF MICROSCOPES**  
COMPLETE IN EVERY DETAIL  
On request to interested persons

**BAUSCH & LOMB OPTICAL CO.**  
Rochester, N. Y.

New York Chicago



*It is not necessary to use a*  
**MICROSCOPE**

*To see the necessity, in these times, of having*  
**GOOD PRINTING**  
*or to discern the DISTINCTIVE merits of the work done by*

*The Post Express Printing Co.*

*Rochester, N. Y.*

# BAUSCH & LOMB-ZEISS. STEREO BINOCULAR GLASSES

DWARF IN SIZE - GIANT IN POWER

THE MARVELLOUS

## STEREO Binoculars

Used by the Armies and Navies of the World

Invaluable for Tourists, Sportsmen, Yachtsmen and general use.  
Smallest, lightest, most powerful; immense field of view  
Only glass giving natural Stereoscopic image.

AN EXQUISITE GIFT

Sold by all Opticians. Send for Prism Stereo Booklet.  
Catalog of microscopic photo lenses and chemical apparatus on request.

BAUSCH & LOMB OPTICAL CO. - - Rochester, N. Y.



# ARCHITECT'S FOOD.

## Grape-Nuts Turned into Big Buildings.

The duties of an architect are so multitudinous, looking after the thousand and one details required in the construction of large buildings, that many of them suffer from the constant mental application and require the best of food to keep up their work. The chief draughtsman in the office of R. T. Newberry, Architect, at 1227 New York Life Building, Chicago, by name, Henry C. Hengels, says:

"After nine months' constant application in the preparation of the necessary plans and details for the large hotel known as the Post Tavern and the Post Building, at Battle Creek, as well as several other large institutions, I found myself in a very debilitated and dyspeptic condition and unfit for work.

"Instead of medical treatment, I used Grape-Nuts food in place of the usual breakfast cereals. The first few days gave great encouragement, and after a week's use, quite an appreciable improvement manifested itself. Since then, daily use has entirely restored the digestive functions to their normal healthy condition, and I have gained about one pound per week. I am now entirely well and strong again and am able to apply myself to work with more than usual vigor. I consider Grape-Nuts a most valuable food for all brain workers. The help this food has given me is incalculable."

# HARD LINES

## To Make a Man Toe the Mark.

To take both tobacco and coffee away from a man seems pretty tough, but the doctor ordered me to quit both, as my health was very poor, and I had got where I could do but little work.

About a month after quitting I commenced on tobacco again because I could hardly stand it. I got along without the coffee for the reason that I had taken up Postum Food Coffee, which I found very relishing to the appetite, and wonderfully beneficial.

I have gained twenty-five pounds by its use, and to-day I am a well man. I discovered in this way that it was the old fashioned coffee that hurt me and not the tobacco. When I first tried Postum I did not relish it, but found that it was not made right, that is, they did not boil it long enough. Next time it came on the table it was fine, and I have been using it ever since.

Mr. Fletcher, an old soldier of this place, was troubled with dyspepsia. I told him of my experience and my cure, and told him to quit coffee and use Postum Food Coffee. This was some time ago. I saw him yesterday and he told me he had not felt better in twenty years, and nothing would induce him to go back from Postum to the use of common coffee. He had the same trouble in getting it made right to start with.

John Ashford, of Dillon, was also troubled with dyspepsia. I told him of my cure by the use of Postum Food Coffee, and warned him to be careful in having the Postum cooked long enough when he did try it. To-day he is perfectly well and his appetite never better.

I could give you the names of a number of others who have been benefited by using Postum Food Coffee. I believe you are a true friend of suffering humanity.—Thomas Spring, Deavertown, Ohio.

"A Weekly Feast to Nourish Hungry Minds."—*N. Y. Evangelist.*

FOUNDED BY E. LITTEL IN 1844.

# THE LIVING AGE

A WEEKLY MAGAZINE OF  
FOREIGN PERIODICAL LITERATURE

A Necessity To Every Reader of Intelligence and Literary Taste

The publishers of THE LIVING AGE take special pleasure in announcing **Three Attractive Serials**. Heinrich Seidel's story THE TREASURE, translated for THE LIVING AGE by Dr. Hasket Derby, was begun in the number for October 6. It will be followed by A PARISIAN HOUSEHOLD, a clever story of Parisian high life by Paul Bourget, translated for THE LIVING AGE by Mary D. Frost; and by Edmondo de Amicis' striking autobiographical sketches, MEMORIES OF MY CHILDHOOD AND SCHOOL-DAYS, translated for THE LIVING AGE from the Nuova Antologia. These serials are copyrighted by THE LIVING AGE and will appear only in this magazine.

**Each Weekly Number Contains Sixty-Four Pages,**

In which are given, without abridgment, the most interesting and important contributions to the periodicals of Great Britain and the Continent, from the weighty articles in the quarterlies to the light literary and social essays of the weekly literary and political journals. **Science, politics, biography, art, travel, public affairs, literary criticism** and all other departments of knowledge and discussion which interest intelligent readers are represented in its pages.

**Each Number Contains**

A short story and an instalment of a serial story; and translations of striking articles from **French, German, Italian** and **Spanish** periodicals are made expressly for the magazine by its own staff of translators.

**Once a Month a Special Supplement Number**

Presents readings from the most important new books, editorial notes on books and authors, and a list of books of the month.

**In Quantity as well as Quality,**

THE LIVING AGE invites comparison with other magazines, being in this regard the equal of any two literary monthly publications in the country. It gives its readers annually **about 3,500** pages.

THE LIVING AGE has ministered for **over fifty-six years** to the wants of a large class of alert and cultivated readers, and is today perhaps even more valuable than ever to those who wish to keep abreast of current thought and discussion.

Published **WEEKLY** at \$6.00 a year, postpaid. Single numbers 15 cents each.

**FREE!** UNTIL THE EDITION IS EXHAUSTED there will be sent, on request, the numbers of THE LIVING AGE containing Heinrich Seidel's story, THE TREASURE, as above, to each NEW SUBSCRIBER for 1901.

Address  
P. O. Box 5206.

THE LIVING AGE COMPANY,  
Boston.

# MOUNTED OBJECTS FOR THE MICROSCOPE

TWENTY-FIVE CENTS EACH.

The following list represents a lot of fine mounted objects which have accumulated in our stock, and which are not listed in our present catalogue. Some of them are by such famous preparers as Cole, Moeller, etc., and all were rare and high-priced. Some now have mounts marred slightly, or some small defect which does not interfere with them as specimens, but most of them are still as good as when first prepared. We have only one specimen of some of the slides, and it will be well to include a duplicate second choice when ordering. This is a fine chance to obtain many rarities very cheap.

- Liver of Toad (Moeller's).
- Hydra vulgaris Entire (Moeller's).
- Bassia longifolia, sections (Moeller's).
- Surirella elegans (Moeller's).
- Philota elegans (Moeller's).
- Turricula spadicea, trans. section of shell (Moeller's).
- Section of Cornea, stained with gold (Moeller's).
- Foot of Horse, injected.
- Anthophyllite, section, Gowanus, N. Y.
- Epidermal Organs on Leaf of *Mentzelia Floridanum*.
- Cerebrum in General Paralysis.
- Inorganic Salts.
- Pleurosigma attenuatum, in Balsam.
- Hair of Chinchilla.
- Animal Hair—Mink.
- Leg of Atypus (Trap-door Spider).
- Scapolite, section.
- Spicules (ruby colored).
- Diatoms from 1st Spring, Salt Lake Desert.
- Diatoms from Volusia, Fla.
- Bacteria fermo—6th Generation.
- Hornbeam Stem, *Carpinus americana*.
- Colon, acute inflammation.
- Kalium chloratum.
- Trans. Section *Mimosa lupulina* (sensitive plant).
- Long. Section, Fruit Body of *Cynaphallus caninus*.
- Epidermis, *Helonias bullata*.
- Polysiphonia.
- Pollen, *Salvia splendens*.
- Trans. Section *Ricinus communis*.
- Trans. Section *Casuarina equisetifolia*.
- Stigeochlorium.
- Zygnuma.
- Cyst of Liver, *Tenia echinococcus*.
- Cancer of the Liver.
- Kidney of Mule (blind staggers).
- Angio Sarcoma, Axilla.
- Sarcoma of the Ovary.
- Laminaria, trans. section.
- Cancer of the Kidney.
- Cancer of the Ovary.
- Hydrodictyon.
- Sequoia gigantea.
- Plant Hairs, *Lepicystis sepulta*, opaque.
- Squash Stem, sieve tissue.
- Abies, Douglas Spruce.
- Hairs on Leaf of *Onosmodium virginiarium*, opaque.
- Petiole of Palm.
- Abutilon pedunculare.
- Stellate Hairs on Leaf of Olive, opaque.
- Leaf of *Myrica cerifera*.
- Scales on Leaf of *Chenopodium album*, opaque.
- Spore-cases of Fern, *Notholoma de albata*, opaque.
- Croton Leaf, Latex Vessels.
- Myxo Sarcoma (new born child).
- Kidney of Rat.
- Young Oysters from Whitstable, opaque.
- Medulla of Dog, stained.
- Kidney, stained.
- Kidney of Kitten.
- Ovary of Kitten, stained.
- Liver, Cirrhosis.
- Pernicious Comatose Malaria, Spleen.
- Oesophagus of Cat.
- Spiracle of Water Beetle.
- Cerebrum of Dog.
- Testis and Epididymus.
- Human Fibrous Tissue.
- Oesophagus and Trachea of Rat.
- Gizzard of Locust showing Teeth.
- Uterus of Heifer.
- Blood of Sheep.
- Strychnia Sulphate Crystals.
- Entozoa in Liver of Rat.
- Lip of Child.
- Testis of Rabbit.
- Aristolochia siphon.
- Shell Sand, Bermudas.
- Stomach of Ground Hog.
- Kidney of Ground Hog.

- Ovary, Hog (Mæller's).  
 Pulmonary Consumption (Mæller's).  
 Lung, Toad (Mæller's).  
 Duodenum from Mouse (Mæller's).  
 Pancreas from Crow (Mæller's).  
 Oenothera Pollen.  
 Heliopella, etc., fossil.  
 Cork, sections.  
 Lagetta linetaria, long. sect. bark.  
 Phiolsa elegans (Mæller's).  
 Euphorbia, milk vessels (Mæller's).  
 Ailanthus glandulosus, sections (Mæller's).  
 Mahogany, sections (Mæller's).  
 Pinus, Pollen (Mæller's).  
 Equisetum, Spores (Mæller's).  
 Sideoxylon cinereum, sections (Mæller's).  
 Philota elegans (Mæller's).  
 Coffea, sections (Mæller's).  
 Tuga dulcis, sections (Mæller's).  
 Autocarpus integrifolia, section (Mæller's).  
 Diatoms from Loch Kinnaria, Scotland (Mæller's).  
 Diatoms from Peru Guano (Mæller's).  
 Diatoms from Dredgings, Manham (Mæller's).  
 Diatoms from St. Vincent (Mæller's).  
 Diatoms from Edible Earth, from Java (Mæller's).  
 Diatoms from Toomeel Bridge, Ireland (Mæller's).  
 Diatoms from North Sea (Mæller's).  
 Plagic Diatoms, from Behring Sea (Mæller's).  
 Free Trichina, female (Mæller's).  
 Plagic Diatoms, from Southern Seas (Mæller's).  
 Vorticella on Condyllophora (Mæller's).  
 Diatoms from Brazil (Mæller's).  
 Phylloxera (Mæller's).  
 Diatoms from Honduras (Mæller's).  
 Diatoms from Hammerfest (Mæller's).  
 Plagic Diatoms, from Java (Mæller's).  
 Diatoms in Dredgings, from St. Vincent (Mæller's).  
 Diatoms in Dredgings, from Kiel (Mæller's).  
 Lingula anatina (Mæller's).  
 Diatoms from Japan (Mæller's).  
 Plagic Diatoms, from Arctic Ocean (Mæller's).  
 False Sago (Mæller's).  
 Bean, section (Mæller's).  
 Copper Crystals (opaque) fine (Mæller's).  
 Gold Bearing Sand, opaque (Mæller's).  
 Echinocardium australe (Mæller's).  
 Pinus, section (Mæller's).  
 Anatenonularia intermedia (Mæller's).  
 Arrow Root Starch (Mæller's).  
 Stomach of Cricket (Mæller's).  
 Jaccaranda ovalifolia, sections (Mæller's).  
 Parenchyma in Root (Mæller's).  
 Ceramium rubrum (Mæller's).  
 Oil Glands in Lemon (Mæller's).  
 Hammerfest Peat (Mæller's).  
 Stomach of Field Cricket (Mæller's).  
 Free Trichina, male (Mæller's).  
 Blood of Frog (Mæller's).  
 Paludina vivipera, Tongue (Mæller's).
- Isthmia neroosa, Pacific Coast.  
 Sacidium lignarium.  
 Pituidary Body, human.  
 Timbriaria tenella, Spores and Elaters.  
 Cartrius latitenta, Statoblasts.  
 Sarracenia variolaris.  
 Hair of Peccary.  
 Diatoms from New Hampshire.  
 Sago Starch.  
 Scolapendea, Arrow Hairs.  
 Pia Mater.  
 Porcupine Quill.  
 Acute Appendicitis, early stage.  
 Navicula oculata.  
 Geranium, trans. fibro vascular bundles.  
 Sangries talpæ.  
 Acerontia atropos, Hair.  
 Chondro Sarcoma.  
 Spindle cell Sarcoma.  
 Skin of Sole.  
 Medulla, trans. section.  
 Cladophora.  
 Buckwheat Starch.  
 Inflamed Subcutaneous Tissue.  
 Scaphalite, section.  
 Triceratum Favus.  
 Adenoma from Ovary.  
 Solanum mammosum, double stained.  
 Navicula firma.  
 Dermoid Cyst, forehead.  
 Fossil Wood, section.  
 Roe Horns, long.  
 Asparagin (Polar).  
 Amphipleura pellucida (Moissac, France).  
 Dragon Arum, Cuticle (Polar).  
 Navicula nobilis.  
 Bronchial Gland, Nailer's Consumption.  
 Peronospora infestans in Potato.  
 Hypertrophied Gland from Neck.  
 Enteromorpha intestinalis.  
 Rice Starch.  
 Hippopæ rheumoides, leaf.  
 Fresh Water Diatoms, from Hammoton, N. J.  
 Cocconema gastrodes.  
 Diatoms, from Georgetown, Mass.  
 Potato Starch.  
 Sparganum Ramosum, base of leaf.  
 Trifolium pratense, trans. section petiole.  
 Littorina litorea, tongue.  
 Condyloma.  
 Liver, Gummatus.  
 Scales of Skin of Sword Fish.  
 Cirisium arvense, trans. section.  
 Tabellaria fenestrata.  
 Lung of Saw Grinder.  
 Ricinus, Crystalloids.  
 Supra Renal Capsule.  
 Spleen.

## MARKET BULLETIN.

## CURRENT MARKET PRICES.

OF

## CHEMICALS AND CHEMICAL APPARATUS.

Quotations are for quantities indicated. Larger quantities at correspondingly lower rates.

	25 grams.	500 grams.
<b>Acid Valerianic</b> , trihydrated,	.25	
" " monohydrated,	.25	
" <b>Perchloric</b> , pure,	.30	
" <b>Pyrophosphoric</b> ,	.35	
" <b>Tungstic</b> , c. p.,	.50	
" <b>Canadic</b> , com'l.,	2.50	
" <b>Phosphorus</b> , cryst.,	.50	
" <b>Tungstic</b> , pure,	.25	3.00
" <b>Tungstic</b> , com'l.,	.15	1.50
" <b>Carbolic</b> , c. p. cryst.,	1.00	
<b>Aluminum Nitrate</b> , pure, exsicc.,	.20	2.00
<b>Ammonium Hypophosphite</b> ,	.40	
<b>Amidophenol</b> , para., pure, cryst.,	.60	
<b>Benzaldehyde</b> ,	.15	1.50
<b>Bismuth Oxychloride</b> , subchloride,	.40	
" <b>Oxide</b> , anhydrous,	.75	
<b>Calcium Chloride</b> , pure, crystal,	.20	
" " com'l., cryst.,	.15	
" " c. p., fused,	.75	
<b>Caseine</b> , c. p.,	.50	5.00
" com'l.,	.50	
<b>Chloroform</b> , pure,	1.00	
<b>Calcium Sulphide</b> , white, powder,	.80	
<b>Demethylamide</b> , azobenzole,	.60	
<b>Ether Benzoic</b> ,	.40	5.00
" <b>Formic</b> , absolute,	.40	4.00
" " conc.,	.20 net.	2.25
" <b>Ozonic</b> ,	.25 "	2.75
<b>Gypsum</b> , com'l. cryst.,	.25	
<b>Iron Citrate and Ammonia</b> , brown,	.15	1.50
<b>Manganese Chloride</b> , c. p., cryst.,	.40	
<b>Naphthylamine Beta</b> ,	1.50	
<b>Potassium Caustic</b> , fused, white, sticks,	.50	
" <b>Carbonate</b> , pure, from Tartar,	.35	
" <b>Tartrate</b> , pure, powder,	1.00	
<b>Sodium Chloride</b> , c. p., fused,	.80	
" <b>Stannate</b> ,	.75	
" <b>Nitrite</b> , com'l.,	.40	
<b>Tin Chloride</b> , c. p., cryst.,	1.00	
<b>Zinc Acetate</b> , pure, cryst.,	.50	

BAUSCH & LOMB OPTICAL CO.,  
ROCHESTER, N. Y.

# The Botanical Magazine

A Monthly Journal of Botany in Japan and  
the Organ of the Tokyo Botanical Society.



THE BOTANICAL MAGAZINE contains original articles in the Japanese and European languages on all subjects of Botany, contributed chiefly by Japanese Botanists of the day. It also contains Reviews ('Referat') of recent botanical works, notes on botanical subjects, proceedings of the Tokyo Botanical Society, etc.

SUBSCRIPTION PRICE per annum (including postage) for Europe, 10 Francs (=8 shillings) and for America, 2 dollars.

ALL LETTERS AND COMMUNICATIONS to be addressed to the Tokyo Botanical Society, Botanical Institute, Science Coll., Imperial University, Tokyo, Japan.

REMITTANCES from foreign countries to be made by postal money order, payable in Tokyo to S. Yoshizoe, Botanic Garden, Imperial University, Tokyo, Japan.

FOREIGN AGENTS : { Oswald Weigel, Leipzig, Königsstrasse 1, Deutschland.  
Gebrüder Borntraeger, Berlin S. W. 46, Schönebergerstrasse 17a, Deutschland.  
Publication Department Bausch & Lomb Optical Co., Rochester, N. Y., U.S.A.

SAMPLE COPIES MAILED FREE.

Apply to Publication Department Bausch & Lomb Optical Company, Rochester, N. Y.

Original Articles in the February Number, 1900.

MATSUMURA, J.—*Plantæ arborescentes tempore hiemali anni 1897 in provinciis Aura et Kazusa, Japoniæ mediae orientalis inter 35° et 35° 30' Lat. observatae.*

ITO, T.—*Plantæ Sinenses Yoshianee.*

MAKINS, T.—*Plantæ Japonenses novæ vel nimes cognitæ.*

MAKINS, T.—*Bambusaceæ Japonicæ.*

#### ARTICLES IN JAPANESE.

MIYAKE, K.—On the starch of evergreen leaves and its relation to carbon assimilation during winter.

MAKINS, T.—Contributions to the study of the Flora of Japan XXII.

# The American Naturalist

## SPECIAL OFFER

ALL new subscribers to the volume for 1900, paying the full subscription price of \$4.00 a year in advance, may obtain the back volumes for the years 1892, 1893, 1894,\* 1895, 1896, and 1897, upon the following terms: any single volume will be sent upon payment of \$2.00; any two volumes for \$3.50; any three volumes for \$4.00; any four volumes for \$4.50; and five or six volumes for \$1.00 each, in addition to the regular subscription. This offer holds good until the stock of back volumes is exhausted. Volumes for 1898 and 1899, \$4.00 each.

---

\*We cannot supply numbers for April and June, 1894.

**GINN & COMPANY, PUBLISHERS**

9-13 TREMONT PLACE, BOSTON.



# ANNOUNCEMENT

WE MAKE A SPECIALTY of supplying *foreign* periodicals with promptness and accuracy, having a special department devoted exclusively to the wants of professors and teachers. We probably supply more college, public and private libraries than any other house.

PROFESSORS will conserve their interests in placing their wants with a reliable company.

HAVE WE EVER SERVED YOU? If not, and should you fail to receive a copy of our TRAVELING SALESMAN, containing a complete list of the more important publications with discount rates, a postal request will enlighten you. Send in your list of publications for estimate before ordering.

SMITH SUBSCRIPTION AGENCY, 168 BROWN STREET, ROCHESTER, N. Y.

The Most Popular Photographic Magazine in the World.

## THE PHOTOGRAM

Is pre-eminent for the excellence of its printing and illustration, and has been early and directly in touch with every step in photographic progress which has occurred since its establishment. It consists of 32 pp. and a valuable supplement monthly, and frequently gives *special* and *double* numbers at the ordinary price. The artistic and technical sides are equally well catered for, and we cannot quite understand how any active photographer (amateur or professional) can afford to be without such a magazine, the cost of which is only 25 cents per month, post-free, or \$2.00 per annum. Of all photo dealers, or of the publishers in

NEW YORK:—TENNANT & WARD, 289 FOURTH AVENUE.  
“ “ SPON & CHAMBERLAIN, 12 CORTLANDT ST.

LONDON:—DAWBARN & WARD, FARRINGDON AVENUE, E. C.

## THE PHOTO-MINIATURE

Is a monthly magazine of photographic information which, month by month, tells the whole story about one branch of photographic work at one time. Illustrated.

A copy of the magazine best explains its scope. Send 25 cents for the current issue and ask for our new book-list. NOTHING ELSE LIKE IT IN PHOTOGRAPHIC LITERATURE.

TENNANT & WARD, Publishers, 287 Fourth Ave., New York.

# THORNTON-PICKARD

SHUTTERS

Time and Instantaneous.

The finest working shutters made; work with great accuracy and simplicity; will not injure the lens by constant jarring, and will not get out of order easily. Repair bills will be small and far apart. They light the plate with great uniformity, and are the most desirable made for general use.

## FOCAL PLANE SHUTTERS

Are photographic marvels; they are as strong, simple, and accurate as the Time and Instantaneous, but work at enormous rapidity—can be used at one one-thousandth of a second; they pass a vast amount of light, and are indispensable for work with objects moving too rapidly for the ordinary shutter to manage.

### THE NEW THORNTON-PICKARD TIME EXPOSURE VALVE.

Regularly exposes up to three seconds. Fitted to old shutters for \$2.00.

**SEND FOR THORNTON-PICKARD CATALOGUE.** Be sure to send for our 1900 Photo Encyclopedia. It is the most complete photographic catalogue, instruction book, and general reference book published. There are a number of valuable special articles. Every volume has a discount sheet. Price, 20c. postpaid.

**ANDREW J. LLOYD & Co.,**

DEALERS IN  
PHOTOGRAPHIC SUPPLIES.

323-325 WASHINGTON ST., BOSTON.

## Go to College

WRITE and learn how you can secure a scholarship in your choice of over 300 leading colleges, conservatories, and professional schools.

Catalogues furnished on application. State age, what you wish to study, first and second choice of school, previous educational advantages, and when you desire to enter. Sample copy magazine free. Address nearest office.

Western College Magazine Information Bureau O

CHICAGO.

ST. LOUIS.

KANSAS CITY.

# FRANK LESLIE'S POPULAR MONTHLY

10 CENTS. \$1.00 A YEAR.

## THE MAGAZINE OF THE NEW CENTURY.

Justly termed: "The most popular household magazine, and one of the best illustrated periodicals in America." Among the contributors who have made Leslie's famous are:

Wm. Dean Howells.	"Josiah Allen's Wife."
Joel Chandler Harris.	F. Hopkinson Smith.
Ruth McEnery Stuart.	Frank L. Stanton.
Frank R. Stockton.	Gen. Nelson A. Miles.
Bret Harte.	Sec. of the Navy Long.
Mary E. Wilkins.	Gen. Wesley Merritt.
Will Carleton.	Sec. of the Treasury Gage.
A. Conan Doyle.	Mary A. Livermore.
Rev. Dr. Henry van Dyke.	Capt. Robert E. Lee.
Stephen Crane.	A. A. Quiller-Couch.
S. R. Crockett.	Harriet-Prescott Spofford.

Send for illustrated prospectus, free.

FRANK LESLIE PUBLISHING HOUSE,  
NEW YORK.

By arrangement, we offer to our readers a year's subscription to LESLIE'S MONTHLY and the "Journal of Applied Microscopy," for \$1.30. Both publications can be sent to one address or to separate addresses.

JOURNAL OF APPLIED MICROSCOPY, Rochester, N. Y.

AMATEUR PHOTOGRAPHERS!

DO YOU READ

## THE CAMERA AND DARK ROOM

The Best Magazine Published Devoted to  
Your Interests.

### "Plain but Practical"

One Dollar Per Year.

Ten Cents Per Copy.

FOR SALE BY CAMERA DEALERS.

A ONE DOLLAR RAY SCREEN  
is now being given free to all new subscribers.

PUBLISHED MONTHLY BY

The Camera and Dark Room Co.,  
28 Cortlandt St., New York City, U. S. A.

"Ainslee's Magazine is, honestly, the most readable periodical in the country."—Concord (N. H.) Evening Monitor.

# March Ainslee's

The Miles-Corbin Feud  
Uruguay's Progressive Ruler  
*By Douglas White*

After Dinner Speakers  
*By George B. Mallon*

Ballad of Eliphalet Jones  
*By Holman F. Day*

The Yellow Journal  
*By Allen Sangree*

Siwash  
*By Jack London*

The Decay of Manners  
*By John Gilmer Speed*

The Lottery Ticket  
*By Rafael Sabatini*

The Traffic of the Country  
*By Arthur I. Street*

Other Stories and Poems

Street & Smith, Publishers,  
New York

# THE ATLAS TABLETS

ARE PREPARED IN THE FOLLOWING  
SERIES:

**SCIENCE**—For laboratory notes and drawings in  
Physiography, Biology, Botany, Zoology, Physics,  
Chemistry, Physiology, Geology, Herbarium.

**MATHEMATICS**—For written work in Mathematics,  
Geometry, Analytical Geometry, Trigonometry,  
Calculus.

**OUTLINES**—With topics and for notes in U. S.  
History, \*General History, English Grammar,  
\*Literature, Rhetoric.

\*In preparation.

Send for Price-Lists and Sample Sheets.

# Central School Supply House,

CHICAGO, . . . . . Atlas Block.  
NEW YORK, . . . . . 103 Fifth Avenue.  
ATLANTA, . . . . . English-American Block.

# Arnold General Purpose Steam Sterilizers.



IMPROVED STYLE WITH SIDE DOOR.

THESE Sterilizers are inexpensive and maintain an unvarying temperature of 100° C. (212° F.) in all parts of the Sterilizing Chamber without any care or attention. They are recommended on account of their low price to all laboratories where a number of Sterilizers are required.

Their use by the following institutions is a sufficient guarantee of their efficiency.

HARVARD UNIVERSITY, YALE UNIVERSITY,  
CORNELL UNIVERSITY, UNIVERSITY OF PENN.,  
JOHNS HOPKINS UNIVERSITY,  
MASS. SCHOOL OF TECHNOLOGY.

Complete Catalogue of Sterilizers mailed on application.

WILMOT CASTLE & CO.,

16 Elm Street.

ROCHESTER, N. Y.

# REICHERT'S

Microscopes,  
Microtomes and  
Accessories.

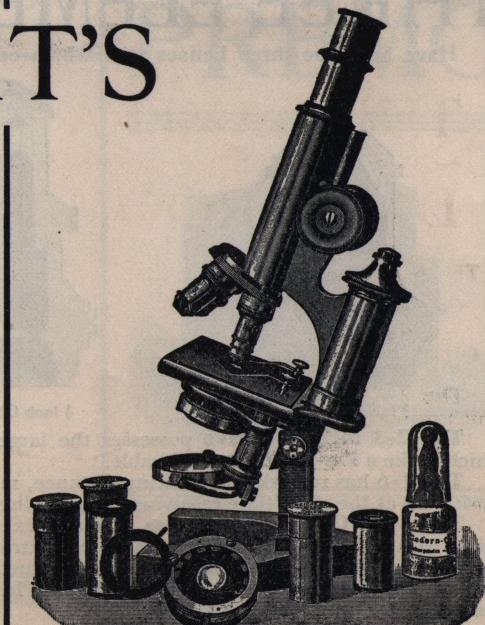
Also Importers and Dealers in

Chemical, Physical and  
Bacteriological Laboratory  
Outfits.

RICHARDS & CO. Ltd.

New York,  
12 East 18th Street.

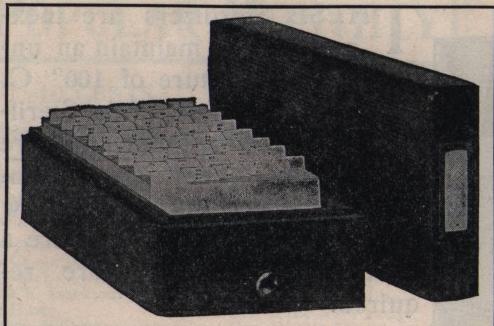
Chicago,  
108 Lake Street.



This Cut Represents Our REICHERT III B Microscope  
(reduced size).

Information and prices furnished on application.

# The Card Index for Laboratory Records



WE MAKE { Single Tray Outfits.  
Desk Drawer Outfits.  
Cabinet Outfits—from one drawer up. } Single or Double Drawers.

Send for catalogue and sample cards or information regarding any form of record which you may have in mind.

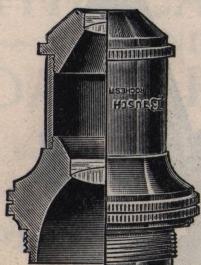
**YAWMAN & ERBE MFG. CO.**

Successors to Office Specialty Mfg. Co.,  
Factories and Main Offices, Rochester, N. Y.

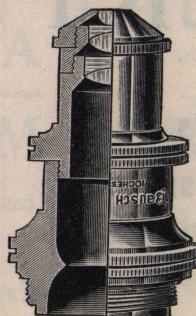
BRANCHES: Chicago, 138 Wabash Ave. New York, 360 Broadway. San Francisco, 29 New Montgomery St.  
Toronto, Canada, The Office Specialty Mfg. Co., Ltd., 77 Bay St.

## THREE ELEMENTS OF OUR SUCCESS

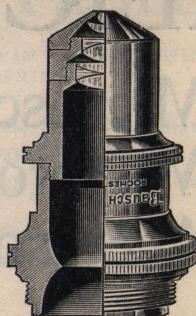
Have been the three Lenses with which our most popular Microscopes are equipped.



$\frac{2}{3}$  inch Objective.



$\frac{1}{2}$  inch Objective.



$\frac{1}{2}$  inch Oil Immersion Objective.

**The 2-3 inch Objective** possesses the large field, depth of focus, and high resolving power which make a low-power lens desirable.

**The 1-6** has remarkable working distance, making it especially adapted to general laboratory work, and at the same time resolving, magnifying, and illuminating power equal to the best.

**The 1-12 Oil Immersion** has so many excellent features that only a trial can demonstrate them. Unusually long working distance, extreme flatness of field, high resolving power, and absolute permanency of the materials of construction are a few of the good qualities. Our method of mounting the delicate hemispherical front lens secures the greatest possible permanency and the least liability to leakage.

**Bausch & Lomb Optical Co.,**

Branches: NEW YORK and CHICAGO.

N. St. Paul St., ROCHESTER, N. Y.

# THE PREMO

---

The Best Camera Made

Fitted with all the latest improvements and supplied with the Victor Lens and Shutter. Our absolute guarantee goes with every Premo sold.

**The Premo Uses Both Glass Plates and Film**

---

1900 Catalogue sent on application.

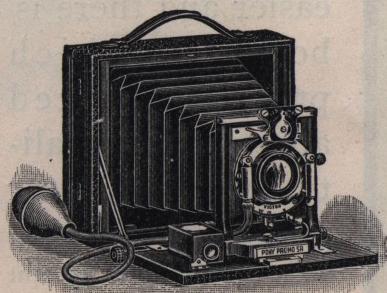
---

Rochester Optical Co., South Street,  
Rochester, N.Y.

# THE PONY PREMO

---

---



---

---

is a special camera for wheelmen. So compact and portable that it can be attached to a bicycle the same as a tool bag. Price, \$10.00 and upward.



# NEW Ground Label Reagent Bottles

---



---



WE HAVE recently perfected a process by which we are able to label any kind or size of bottle with any combination of letters or figures at a very moderate cost, and any variety of inscription is as easily and quickly done as a duplication of a single name. The label appears on the bottle as a smoothly ground area with the letters and figures in polished glass. Thus, whether the bottle is filled with a light or a dark fluid, the label is always easily legible and the appearance is much neater than that of raised letters or of labels cemented to the bottle. The containers are kept clean much easier and there is a great saving in the cost. The bottles on which prices are quoted are extra fine quality and extra clear glass. Sample bottle, showing label, will be sent free to laboratories.

**GLASS STOPPERS—Tincture or Narrow Mouth.**

Contents CC . . . . .	125	250	500	1000	2000
Price per 10 . . . . .	\$1.50	2.00	2.75	3.75	5.00

**GLASS STOPPERS—Salt or Wide Mouth.**

Contents CC . . . . .	125	250	500	1000
Price per 10 . . . . .	\$1.75	2.25	3.00	4.00

Above prices are for bottles labeled to order, and are subject to usual discount. Packing and transportation extra.

**Bausch & Lomb Optical Co.,**

ROCHESTER, N. Y.

BAUSCH & LOMB  
OPTICAL CO.  
PHOTOGRAPHIC OBJECTIVES  
SHUTTERS AND ACCESSORIES

BAUSCH & LOMB  
OPTICAL CO.  
PHOTOGRAPHIC OBJECTIVES  
SHUTTERS AND ACCESSORIES

THERE ARE NOW IN USE OVER

# 234,000 LENSSES

Manufactured by the Bausch & Lomb Optical Co.

This enormous number represents only Bausch & Lomb-Zeiss Anastigmat, Rapid Universal, Alvan G. Clark, Rapid Rectilinear, Portrait, and Wide Angle Lenses, and does not include the millions of simpler photographic lenses produced.



MANUFACTORY OF THE BAUSCH & LOMB OPTICAL CO.

THE POPULAR VERDICT as expressed by actual purchase and use is that our Lenses are practically WITHOUT A RIVAL.

OUR PRODUCTS ARE OBTAINABLE FROM ALL DEALERS.

CATALOGUE FREE.

**Bausch & Lomb Optical Co.**  
ROCHESTER, N. Y.

NEW YORK CITY,  
Broadway and 25th Street.

CHICAGO,  
State and Washington Sts.

BAUSCH & LOMB  
OPTICAL CO.  
PHOTOGRAPHIC OBJECTIVES  
SHUTTERS AND ACCESSORIES

BAUSCH & LOMB  
OPTICAL CO.  
PHOTOGRAPHIC OBJECTIVES  
SHUTTERS AND ACCESSORIES



# SYNTHOL

(ABSOLUTE)

A chemically pure synthetic sub-  
stitute for absolute ALCOHOL.

PURER, STRONGER, MORE STABLE, CHEAPER.

**S**YNTHOL may be used for every purpose for which alcohol is used, except for internal consumption. Being chemically pure it does not have as much odor as absolute alcohol from grain or wood. It is perfectly free from color, is non-irritant to eyes or skin and has from ten to fifteen per cent. more solvent power than ordinary alcohol.

PRICES:

1 pint, net . . . . .	\$ .40
1 gallon, net . . . . .	2.50
1 bbl. of 50 gallons per gallon, net,	2.25

As a killing, fixing, or hardening agent it is in every respect equal to the best absolute alcohol and can be used as a substitute for it in the preparation of stains, reagents, etc. We offer a special low price on Synthol in barrel lots FOR MUSEUM PURPOSES. As a preservative it is superior to any alcohol. Alcohol becomes tinged with color on exposure to light. Synthol retains its absolute colorlessness under all conditions. Sample supplied free to laboratories.

MANUFACTURED EXCLUSIVELY FOR

**BAUSCH & LOMB OPTICAL CO.,**

CHICAGO.

ROCHESTER, N. Y.

NEW YORK.